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[CIRCULAR No. 57.]

FARM DRAINAGE.

ILLINOIS DEPARTMENT OF AGRICULTURE, }
 SPRINGFIELD, August, 1879. }

The increasing demand for information relative to Farm Drainage, has necessitated the publication of a second circular on this subject.

This circular contains an essay, entitled: "Farm Drainage," by Prof. Geo. E. Morrow, Dean of the School of Agriculture, Illinois University; "Important Results from Drainage," by George E. Warring, Esq., Civil Engineer, Newport, R. I.; statements of practical farmers giving results obtained from tile draining, and tables showing the quantity and price at factory, of each size of drain-tile made in 1878, so far as reports could be obtained. The quantity made in 1878, when compared with that reported for 1877, shows an increase of seventy-six per cent., and when compared with that reported as made in 1876, the increase is nearly four hundred and thirty per cent., as will be seen by the following summary:

SIZE.	1876.	1877.	1878.
2 inch.....	978,638	1,900,984	1,862,699
2½ " .....	.....	.....	961,599
3 "	1,237,345	5,540,119	9,996,775
4 "	817,506	3,127,880	6,212,751
5 "	489,243	1,714,201	3,224,232
6 "	273,382	1,131,330	2,019,911
over 6 "	25,389	89,674	519,947
Total,	4,684,853	14,012,913	24,797,914

Two acts were passed by the Thirty-first General Assembly on the subject of Drainage; one entitled:

"An act to provide for the construction, reparation and protection of Drains, Ditches and Levees, across the lands of others, for agricultural, sanitary and mining purposes; and to provide for the organization of Drainage Districts." Approved and in force May 29, 1879; the other, entitled:

"An act to provide for the organization of Drainage Districts, and to provide for the construction, maintenance and repair of drains and ditches, by special assessment on the property benefitted thereby." Approved May 29, 1879; in force July 1, 1879.

The last named Act, relating more especially to Farm Drainage, is published in full in this circular.

Respectfully submitted,

S. D. FISHER, *Secretary.*

FARM DRAINAGE.

BY G. E. MORROW, PROF. OF AGRICULTURE, ILLINOIS
INDUSTRIAL UNIVERSITY.

In no question of agricultural improvement have the farmers of a large part of Ill'nois felt a greater interest during the last three or four years than in that of land drainage. Very much has been written and talked about the work, and very much has been done in it—in the line of under-drainage—probably more in the last three years than in all the previous history of the State. There is very general satisfaction with the results of the work already done, and the interest continues unabated. Many mistakes have been made, however, and there is still much lack of information on the subject. Hence the request for "a plain and practical essay," in response to which this paper is written, was a timely one. What is written is mainly designed for those who have had little or no practical experience in land drainage, and who have given little thought even for the reasons for it and the effects produced.

The most obvious reason for land drainage is the presence of surplus water in the soil. While water is an essential to the growth of plants; while its lack makes a barren waste of what would otherwise be fertile soil, an excess of it is always injurious, often fatal to farm crops. The rain-fall is the primary cause of surplus water in soils. In addition to that which falls directly upon it, a given area of land may receive much water from higher lands near at hand—this water either flowing over the surface, coming from springs, or oozing up from below. The soil also absorbs water from the atmosphere, and receives it in dew, but never in excess from these sources. In all ordinary cases, water is removed from the soil—aside from the action of plants—either by flowing over the surface, by going down to a lower stratum or by evaporation. If the surface be level, or the land be surrounded by higher lying lands, and if the sub-soil be impervious to water, evaporation is the only mode of relieving the soil. This, at the best, is a slow process. The same quantity of heat is required to evaporate a pound of water from the soil that it requires to "boil it away" on a stove. Evaporation is also a cooling process. It is a familiar fact that a wet soil is a cold soil. Water radiates heat readily, but conducts it downward very slowly. Stagnant water not only keeps the soil cold, but it produces unhealthy decomposition and also keeps out the air, and this is one of the greatest sources of harm from it.

When the stagnant water is removed, the air takes its place, bringing warmth with it, changing the injurious products produced by the

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stagnant water into those necessary for the plant, and helping in the formation of additional plant food; bringing also with it fertilizing material collected above the surface of the soil. The fresh water from rains can also enter the soil when the stagnant water has been removed, and moving water is often as beneficial as stagnant water is harmful. It warms the soil; carries into it fertilizing material from the atmosphere; dissolves and distributes other plant food already in the soil, and gives this up to the roots of the plants.

Lands should be drained, then, not only to remove surplus water, but to admit air and moving water. A well drained soil will permit a much greater quantity of water to pass thorough it, and, in time of drought, will be more moist than will one which ordinarily is injured by excess of stagnant water. In the latter soil the water is present because it is held mechanically and cannot get away. When evaporation has, at last, made it dry, such land is usually hard, baked and almost impervious to water, save through large cracks. A well drained soil holds much water by capillary attraction, and in time of drought is continually bringing up additional stores from the lower strata, this water bringing with it valuable plant food it has dissolved. Ordinarily a well drained soil is more moist in a very dry time than is a wet soil.

Other obvious reasons for drainage are that an undrained soil is harder to work, cannot be tilled so early in spring nor so late in fall, usually produces less than that of inferior quality, and is often injurious to the health both of man and beast.

All lands for farming purposes should be well drained, either naturally or artificially. Some are abundantly drained naturally, having a sufficiently porous texture and with a porous sub-soil; but wherever a soil holds water on the surface long after rains, or is cold and wet when other soil is warm and moist, or shows a bleached and feeble growth or a vegetation peculiar to wet lands, or is subject to late frosts in spring or early ones in autumn, from which surrounding land is free, it is evident it would be improved by artificial drainage. It may be that the cost of drainage would be greater than the benefits obtained. It will not do to advise that all lands which would be improved by the process should at once be artificially drained. Good common sense and careful study are needed in very many cases to decide how much may profitably be done and in what way the work may be accomplished to the best advantage.

The most obvious means of draining land would be by improving the facilities for surface drainage, providing better channels through which the water may flow off. It is better, much better, to let the water flow through the soil than to flow over it. In the latter case it may wash the surface; it almost certainly carries off with it some of the finer and better particles of the soil, some of the manure, and most of the valuable gases it holds; whereas, if it goes down through the soil, it leaves all these and improves rather than injures the soil. Yet there are many cases in which the first thing to be done, sometimes the only thing needed to be done, is to improve the surface drainage.

On many prairie farms, ten, twenty, forty acres of land are too wet for profitable culture, if they are not a mere swamp; simply because the natural water channel is winding in course and filled with decaying vegetable matter. In such case, straightening this channel may often reduce its length and increase the rate of fall three-fold, en-

abling it readily to carry off all the surplus water. The water has a less distance to go, the fall is greater, and the resistance by the curving banks and obstructions in the channel is almost all removed.

This supposed case illustrates the importance of determining the cause of the surplus water as a first step in any work in drainage. It may be found that a few springs cause all the trouble, or that water flowing from higher land is the source, and that cutting off this supply by cross drains or thorough drainage of the higher land may be more effective than the most elaborate drainage of the piece of land in question.

There are lands which can only be put in good condition by what is called "thorough drainage"—that is, a system which in every part of the surface is directly influenced by an underground channel or pipe. In certain tenacious soils these may need to be not more than a dozen feet apart; rarely can they be more than sixty feet apart from each other. Such a system, of course, requires the expenditure of much labor, and the total cost, in Illinois, would generally equal or exceed the value of fair lands in the same vicinity. It is fortunate that this thorough drainage is not usually essential to good results. There are many farms in Illinois which it will be found profitable to thoroughly underdrain; there are many more on which this cannot advisably be done, for many years at least. Extreme statements on either side of this question have done harm. The necessity for the thorough work has been unduly pushed, and unfounded statements have been made as to the lack of value of systems of partial drainage. On the other hand, the sufficiency of very slight and partial work has been too often insisted on. It is very fortunate that, generally, the drainage that most needs to be done can be carried on as time, means and opportunity permit, and all be made a part of what may ultimately become a thorough complete work.

The remarkable effects of partial drainage on Illinois prairie soil is no longer a question of mere opinion or theory. In thousands of cases there is practical proof of the good effects—marked even the first year and increasing from year to year. For instance, on the farm of the University we can show proof positive to the most skeptical that even a single line of drain may greatly affect land hundreds of feet distant, and convert an almost swamp into good tillable land.

Underdrains are by far the best in all ordinary cases, and tiles are by far the best material. Mole or stone or brush drains sometimes serve a good purpose, at least for a time; but land drainage should be a work to last indefinitely, and a good drain tile is much the most enduring and effective of any yet devised. Of the various shapes in which these are made, the round is decidedly the best; mainly because such can be made to make closer joints, their form allowing a choice of sides.

The best tile is one which is smooth on the inside, which has not warped in drying or burning, the ends at right angles with the sides, free from cracks or other imperfections, and sufficiently burned to be durable. Most of the water, even where porous tiles are used, gets in at the joints, and there is no danger of getting these too close; there will be abundant opportunity for the water to get in. The water will come in mainly from below and from the sides, only to a slight extent ordinarily from above.

The question as to the best depth at which to lay tile is one much discussed. No positive answer can be given. Of course they should always be below the reach of the plow, better if below the ordinary

range of roots of farm crops, and below the reach of frost in usual weather. How much deeper than this must be determined by the cost of digging—if a good outlet can be secured. In a soil needing drainage, there is a line of saturation. This may be at the surface or one or two feet below. A line of tile will lower this to the level of the tiles. At the sides this line will gradually rise as we go further from the drain. It is evident that the deeper the drain is made the greater the width of land it will affect—unless there is an impervious strata above the line of tiles. Four feet is often recommended, and this depth was formerly insisted on in England. Most of the drains in this State are not over three feet on an average, and this depth answers a very good purpose. The cost of digging a ditch four feet is often nearly twice as great as that of one three feet deep. Where necessary to secure a good outlet the tile may be laid much nearer the surface than this and yet do good work.

The comparative quantity of water carried by two tiles will be pretty nearly as the squares of their diameters, but the smaller the tile the greater the friction. A two-inch tile will carry more than four times as much as a one-inch tile. One of eight inches will carry nearly as much as two of six inches in diameter. There is no advantage in having a tile larger than is sufficient to carry all the water. There are advantages, indeed, in having the tiles flushed occasionally, as this tends to remove the sediment which almost always collects in a greater or less degree. The quality of the tile, the nature of the soil and the rate of fall all greatly affect the quantity of water which a given line of drain will be required to carry off. In the case of an unusually heavy rain, a drain might be overtaxed for a few hours, which would in all ordinary circumstances be abundantly large. Such a contingency need hardly be guarded against, as no special injury will result if water does stand on the ground a few hours.

Prof. Shattuk, of this University, has given a rule which is simple and probably as approximately correct as any yet given. This rule is, that a line of tile will carry the water from as many acres as is the square of the diameter of the tile in inches. That is, a two-inch tile drain will carry the water which flows on four acres; a three-inch from nine acres. This does not imply that a drain of a given size will serve the purpose in a field containing as many acres as is the square of the diameter of the tile, but that it will serve as a main to carry off all the water if collected from that field.

There is more difficulty in properly laying very small tile than larger ones; perhaps more in making good tile of quite small diameter. Aside from these considerations, there is no need of a tile more than one inch in diameter at the starting point of any ordinary drain. From two to four inches for the side or lateral, and six inches for the main drains are very common sizes for ordinary farm drainage.

In laying out the drains for a given piece of land, the first step, as has been said, should be to discover the source of the surplus water. This determined, in almost every case the best channels for removing it will be those which are shortest and most natural. The natural water courses should be followed where these are reasonably direct. The drains should run directly down the slopes rather than diagonally across them. Deep cuts are to be avoided, but are to be preferred to abrupt curves. Most of all, a good outlet should be secured. It is better to sacrifice fall

than a good outlet. A line of tile laid absolutely without fall would carry off much water from a wet soil. An obstructed outlet will nearly destroy the usefulness of any drain. No harm comes from increasing the rate of fall, but the rate should not be decreased if this can be avoided; when it is absolutely necessary to do this, it is well to put in a basin or well in which to catch the sediment, which otherwise would be especially liable to collect at this point. This basin should be a foot deeper than the line of tile, which should start from the lower side, at least an inch or two lower than it enters at the upper side. Where two drains come together, it is better they approach at an acute angle. Where a smaller enters a larger drain, it should do so above the bottom of the latter.

If these general directions are kept in mind, and especial care be taken to have all the work carefully done, there need be no fear of failure.

The services of an experienced engineer are desirable, yet many a farmer, with instruments readily attainable, has laid out a system of drains which has proved very satisfactory in practice. There is always danger in work done by inexperienced men that there will be mistakes of judgment, and still more danger of lack of care in the work. As a rule the most careful work will be found in the neighborhood and on the farms where most has been done. It should be kept in mind that laying a drain tile is, or should be, work designed to last a life time, and that, like a chain, the whole drain may be made almost useless by weakness in a single point—with the advantage in favor of the chain, for with it the weak link can at once be replaced, while the poorly laid tile may only be found after long search.

A regular "level" is desirable, and one suitable for this work can be purchased for ten or twelve dollars. In lack of this, home-made contrivances, in skillful hands, have often answered a good purpose. Perhaps the best of these is made by attaching sights to a carpenter's level, the correctness of which has first been tested. Where the fall is considerable, and reasonably uniform, the primitive mode of determining the slope of the bottom, by simply watching the water as it runs, has been made to answer, but something more accurate than this should be made use of. A triangle of boards, with a base of eight or ten feet, and a plumb line and a "bob" from the top, serves a good purpose. A small line drawn tightly between two points at which the depth desired has been determined can be made use of, and if properly used can be found very satisfactory. Care should be taken that the ditch is dug no deeper than is required at any point. Where this is done there is danger of trouble from the after settling of the earth replaced.

Where the soil is in fair condition it may be advisable to open the ditch with a plow, but the gain from this is not great. A common mistake of inexperienced diggers is that of taking out much more earth than is necessary. For a ditch three feet deep, fourteen or at most sixteen inches is as wide as the first cutting needs to be made. In a large majority of cases an ordinary spade will be found the most serviceable tool. When a depth six inches less than is desired has been reached, at which point the ditch need not be wider than the spade, it is better to substitute a scoop with a semi-circular bottom somewhat larger than the tile to be laid. With it the finishing of the ditch can be better done and

a good bed is made for the tile. The tile may be laid from the bank, but usually it is better for workmen to stand in the ditch. It is possible to take too much care in laying the tile, in getting a close joint, and in carefully covering, but it is vastly more common to have poor work done because too little care is taken. It is better to lay something over each joint, and a piece of sod, grass side down, does well. In clayey soil this is not essential, but is always a help.

The ditch should be filled to a depth of at least six inches at once, and is much better if it be entirely filled very soon. This may be done in good part with a plow. Where ditches are left partly unfilled, there is danger of displacement of the tile by the tramping of stock, and in some cases trouble has come from roots of weeds or grass finding their way into the tile. Roots of trees sometimes cause trouble even when the drains are of considerable depth. The outlet should be protected in some way—best by a brick or stone wall, through which the last tile runs, which may also be further protected by a wire screen, to prevent the intrusion of frogs, toads or snakes.

There are advantages in digging the whole line of ditch, then commencing at the upper end and laying down; but in case of delay in finishing the work, the ditch often gets in bad condition. Good work can be done by commencing at the outlet and putting in even a few rods at a time. Some sediment will be carried into the lower tile, but if the work is carefully done, the first rain will wash this away, and the work can be resumed at convenience. So doing will often much reduce the outlay necessary for well underdraining a farm. If the work be laid out with reference to ultimately making it all that is needed, and if the tile in the main drain be large enough, the work may be done as leisure from other farm work gives opportunity, and may even be extended over a series of years, until, without any special inconvenience from the cost, a total of work has been done which would have been far beyond the available means in any one year.

Closely connected with farm drainage is road drainage. Over much of the prairie region of central Illinois, the "road question" is one of the most important factors in the outlook for future advancement. Ultimately these roads may be macadamized or otherwise improved. For the present better drainage is the best practicable means of improving many of them. Surface drainage will generally be relied on. It is not enough to elevate the road bed. If water stands in pools at the side, the roads will absorb water to their very surface, by capillary attraction. The plan of laying a tile drain under the center of the road or at its sides has been proposed, but as yet very little practiced. The suggestion has been opposed, but on what seem mistaken grounds—the opposers seeming to forget that water can be carried by capillary attraction. It is not to be supposed that any system of drainage will make a good smooth solid road of prairie soil in a wet time, but it must be true that if by means of a tile drain a great part of the water with which that soil is saturated can be carried off, the road will much sooner get in good condition than if the only reliance is on the water running off the trampled and "rutted" surface, and on evaporation. The cost of laying a line of tiles is so slight that especially for "bad places" in the road, it will be well worth making a trial of this plan before condemning it.

DRAIN TILE MADE IN ILLINOIS IN 1878.

COUNTY.	POST OFFICE.	Ft. 2 in.	Ft. 2½ in.	Ft. 3 in.	Ft. 4 in.	Ft. 5 in.	Ft. 6 in.	Over 6 in.	Total.
Brown.....	Mound Station.....	30,000		70,000	80,000	60,000	37,000	75 000	352 000
Bureau.....	Princeton.....	14,552		18,120	10,250	8,450			51 372
Champaign.....	Homer.....		15,000	50,000	30,000	30,000	10,000		120 000
"	Mahomet.....			60,000	55,000	37,000	7,000	6,000	180 000
Christian.....	Pana.....	15,000		45,000	15,000	10,000		4 000	89 000
"	Taylorville.....	5,000		8,000	7,000	5,000	5,000	3,000	33 000
"	Edinburg.....		15,000	18,000	20,000	20,000	20,000		93 000
"	Pana.....		10,000	75,000	20,000	20,000			125 000
"	Rosemond.....	8,000		50,000	10,000	5,000			73 000
Coles.....	Ashmore.....			13,600	33,600	27,300	9,700	7,800	92 000
"	Charleston.....			36,000	60,375	36,000	40,000	5 000	177 375
"	Mattoon.....			30,000	60,000	60,000	30,000	10 000	190 000
"	Mattoon.....		275	15,207	37,978	17,884	7,985	1 066	80 395
"	Charleston.....			20,000	35,000	40,000	30,000	25,000	150 000
DeWitt.....	Farmer City.....	20,000		16,500	21,500	16,000	10,000	3 000	67 000
"	DeWitt.....	21,000		55,000	20,000	9,000	12,000		116 000
"	Kenny.....		30,000	90,000	40,000	30,000	10,000	9 000	200 000
"	Clinton.....		20,000	42,000	50,000	38,600	24,000	1,500	135 500
Douglas.....	Camargo.....			10,000	7,000	1,000	3,000	1 000	22 000
"	Arcola.....		1,200	1,200	1,000	1,000	8,000	8 000	20 400
Du Page.....	Naperville.....	100,000	23,000	106,000	56,000	25,000	40,000		350 000
"	Lombard.....	42,000		73,000	26,500	13,700	6,000	1,250	162,450
Edgar.....	Paris.....			17,264	10,840	4,432	7,200	2,316	42 052
"	Kansas.....			20,000	70,700	51,000	25,500	1 800	169 000
"	Kansas.....			59,500	76,000	34,000	32,500	8,500	210 500
Ford.....	Paxton.....	5,000		24,000	18,000	6,000	3,000		56 000
Fulton.....	Farmington.....	20,000		75,000	20,000	25,000	15,000		155 000
*Gallatin.....	Ridgeway.....	2,000		2,000	1,000	2,000	1,000	1 000	9 000
Greene.....	White Hall.....		33,387	214,288	166,694	74,157	54,000	16,900	579 426
"	White Hall.....	32,000		487,000	310,000	115,000	80,000	23 000	1,047 000
"	Barrow.....	5,000		40,000	50,000	32,000	12,000	3,000	142 000
"	Athensville.....			30,000	38,000	30,000	20,000		110 000
Grundy.....	Morris.....	15,000		30,000	15,000	3,000	1,000		64 000
Hancock.....	Hamilton.....	20,000		20,000	12,000	2,000	1,000		55 000
Henry.....	Geneseo.....	20,000		220,000	50,000	10,000	3,000		303 000
Iriquois.....	Watseka.....			83,000	80,000	20,000	25,000		208 000
"	Del Rey.....			100,000	20,000	12,000	6,000		148 000
"	Milford.....	6,336		58,357	55,172	18,727	16,747		155,339
"	Milford.....		48,000	96,000	48,000	60,000	60,000	3 200	315 200
Kane.....	Aurora.....	140,000	43,000	124,000	41,000	14,000	20,000	9,700	391 700
Kendall.....	Wellington.....	55,000	15,500	95,500	34,000	12,000	12,000		224 000
Knox.....	Maquon.....		5,000	40,000	30,000	5,000	4,000		84 000
"	London Mills.....			80,000	70,000	10,000			160 000
"	Knoxville.....	3,160	16,466	94,171	22,698	8,243	2,000	1,000	147 738
Livingston.....	Fairbury.....			75,000	40,000	35,000	25,000		175 000
"	Forest.....	15,500		59,800	6,400	12,300			94 000
Logan.....	Atlanta.....	9,000		93,500	65,300	40,200	22,500	3,000	233 500
"	Atlanta.....			220,000					220 000
"	Lincoln.....	33,000		44,000	55,000	66,000	22 000		220 000
"	Lincoln.....		50,000	100,000	165,000	135,000	80 000	55 000	585 000
Macon.....	Blue Mound.....	10,000		25,000	25,000	20,000	20,000		100 000
"	Decatur.....		25,000	35,000	35,000	30,000	17,000		142 000
"	Decatur.....		4,000	100,000	85,000	70,000	60 000		319 000
"	Argenta.....	30,000		65,000	55,000	40,000	30 000		220 000
"	Warrensburg.....			30,000	31,000	20,000	15 000	4 000	100 000
"	North Macon.....	17,000		90,000	45,000	13,500	12 000	2,000	179,500
"	Blue Mound.....	20,000		20,000	25,000	15,000	8 000	3,000	91 000
"	Blue Mound.....	4,000		100,000	85,000	70,000	60 000		319 000
Macoupin.....	Virden.....	40,000		92,500	40,000	10,000	10 000	7,500	200 000
"	Palmyra.....	2,000		5,000	6,000	5,000	7,000	2,300	27 000
Madison.....	Alton Junction.....	50,000		60,000	40,000		30 000		180 000
Marshall.....	Sparland.....		30,000	110,000	40,000	30,000	10 000		220 000

*Includes 3½ inches.

Drain Tile Made in Illinois in 1878.—Continued.

COUNTY.	POST OFFICE.	Ft. 2 in.	Ft. 2½ in.	Ft. 3 in.	Ft. 4 in.	Ft. 5 in.	Ft. 6 in.	Over 6 in.	Total.
McDonough	Bardolph	57,738	108,779	1,242,662	609,545	247,004	91,199	36,840	2,393,767
McLean	Bloomington	40,000		500,000	400,000	100,000	50,000	45,000	1,135,000
"	Saybrook		15,000	30,000	30,000	10,000	5,000		90,000
"	Padua		35,000	35,000	35,000	30,000	20,000		155,000
"	Hendrix		15,000	17,000	21,000	3,500	2,500		59,000
Menard	Athens			27,000	44,000	17,000		16,000	104,000
"	Petersburg		10,030	53,000	40,000	21,000	9,000	4,000	137,000
Mercer	Aledo	55,000		76,000	56,000	40,000	28,000	4,000	259,000
Morgan	Chapin		35,450	185,550	103,637	32,045	6,875	3,450	367,007
"	Woodson	2,610	29,774	88,665	56,798	32,965	14,836	7,928	233,576
"	Jacksonville		30,000	60,000	85,000	25,000	15,000	5,000	220,000
Peoria	Summerville	20,000		100,000	60,000	40,000	40,000		260,000
"	French Grove	10,000		100,000	110,000	50,000	30,000		300,000
"	French Grove		12,000	43,000	35,000	22,000	9,500	6,600	128,100
"	Monico	19,279		73,344	41,495	9,891	5,991		150,000
Pike	Pittsfield	12,500	20,000	10,000	5,000	1,500	1,000		50,000
"	Milton	8,000		30,000	30,000	25,000	12,000		105,000
"	Milton		20,000	15,000	20,000	10,000	5,000		70,000
"	Barry	20,000		12,000	5,000	5,000	5,000		47,000
Rock Island	Carbon Cliff	475,000		750,000	160,000	48,000	21,000	1,800	1,455,800
Sangamon	Buffalo	15,000		85,000	100,000	50,000	40,000	10,000	300,000
"	Springfield		500	6,375	13,625	3,030	4,300		27,830
"	Springfield			4,350	6,080	2,400	3,020	1,400	17,250
"	Auburn		12,136	28,856	37,373	17,625	15,957		111,948
Schuyler	Rushville	20,000		50,000	40,000	15,000	1,000		126,000
"	Ray	1,000	2,700	10,000	4,000	1,300	1,000		20,000
Scott	Winchester		30,000	157,000	123,000	39,000	15,000	3,000	367,000
"	Alsey	25,000		130,000	25,000	25,000	10,000	5,000	220,000
Shelby	Windsor	3,000		32,100	32,000	14,000	4,000		85,100
Stark	Wyoming	100,000		100,000	50,000	50,000	45,000	3,000	348,000
"	Lafayette		3,000	50,000	20,000	15,000	6,000		94,000
Tazwell	Pekin	2,857		88,259	39,634	25,674	19,721		176,145
"	Minier			95,000	50,000	40,000	45,000	25,000	255,000
"	Hopedale			125,000	45,000	45,000	55,000		270,000
"	Morton			65,000	40,000	22,000	15,000	2,000	144,000
"	Hopedale			147,000	63,000	52,500	41,000		303,500
"	Delaven	5,000		80,000	100,000	50,000	20,000		255,000
"	Washington		500	88,000	30,000	8,000	6,000		132,500
"	Minier	4,000		36,000	15,000	10,000	16,000	6,000	87,000
Vermilion	Rossville	31,000		76,000	49,000	32,000	18,000	1,400	207,400
"	Georgetown	2,000		28,200		19,000	7,900	4,500	61,600
"	Ridge Farm			60,000	75,000	25,000	15,000		175,000
"	Vermilion Grove			10,000	25,000	25,000	10,000		70,000
"	Indianola			13,800	11,500	5,700	2,400	1,400	34,800
"	Potomac		3,500	7,600	16,500	6,000	5,300	1,100	40,000
Warren	Monmouth	241,520		480,020	248,242	57,944	54,560	7,997	1,090,283
"	Monmouth	20,000		48,000	55,000	20,000			143,000
White	Crossville		15,000	45,000	50,000	50,000	10,000		170,000
"	Grayville		10,432	9,844	13,790	2,398	2,580		44,044
Woodford	Low Point		27,500	35,640	31,680	25,344	6,600		126,764
"	Secor	3,147		49,003	14,845	8,518	4,540		80,053
Total		1,862,699	961,599	9,996,775	6,212,751	3,224,232	2,019,911	519,947	24,797,914
"		1,900,984		5,540,119	3,127,880	1,714,201	1,131,830	89,674	14,012,913
"		978,638		1,237,345	817,506	489,243	273,382	25,389	4,684,853

PRICE PER 1000 FEET OF DRAIN TILE AT FACTORIES—1878.

COUNTY.	POST OFFICE.	2 inch.	2½ inch.	3 inch.	3½ inch.	4 inch.	5 inch.	6 inch.	7 inch.	8 inch.	9 inch.
Brown.....	Mound Station.....	\$12.00	\$.....	\$17.00	\$.....	\$24.00	\$34.00	\$48.00	\$70.00	\$85.00	\$.....
Bureau.....	Princeton.....	12 00	.....	18.00	.....	28.00	38.00	.....	.....	.....	.....
Champaign ..	Homer.....	.....	.....	15 00	.....	25.00	35.00	45.00	.....	.....	.....
.....	Mahomet.....	.....	13.00	16.00	.....	26.00	35.00	45.00	55.00	.....	.....
Christian	Pana.....	20.00	.....	30.00	.....	40.00	45.00	.....	60.00	.....	.....
.....	Taylorville.....	10.00	.....	15.00	.....	25.00	35.00	45.00	65.00	75.00	.....
.....	Edinburg.....	.....	13.00	15.00	.....	22.00	32.00	42.00	.....	.....	.....
.....	Pana.....	.....	12.00	18.00	.....	24.00	30.00	.....	.....	.....	.....
.....	Rosemond.....	12.00	.....	15.00	.....	18.00	32.00	.....	.....	.....	.....
Coles.....	Ashmore.....	.....	.....	16.50	.....	22.00	28.50	38.50	44.50	.....	.....
.....	Charleston.....	.....	.....	15.00	.....	21.00	30.00	36.00	45.06	.....	.....
.....	Mattoon.....	.....	10.00	12.50	15.00	20.00	25.00	35.00	.....	50.00	.....
.....	Mattoon.....	.....	.....	12.00	.....	18.00	24.00	30.00	40.00	50.00	.....
.....	Mattoon.....	.....	.....	15.00	.....	22.00	30.00	35.00	50.00	.....	.....
.....	Charleston.....	.....	.....	12.00	.....	18.00	24.00	30.00	45.00	.....	.....
DeWitt.....	Farmer City.....	.....	15.00	17.00	22.00	25.00	35.00	45.00	.....	.....	.....
.....	DeWitt.....	10.00	.....	15.00	.....	20.00	30.00	40.00	50.00	70.00	.....
.....	Kenny.....	.....	13.00	15.00	.....	23.00	30.00	40.00	.....	70.00	.....
.....	Clinton.....	.....	11.00	13.00	.....	22.00	33.00	40.00	.....	60.00	.....
Douglas.....	Camargo.....	.....	.....	15.00	.....	21.00	30.00	40.00	55.00	70.00	.....
.....	Arcola.....	.....	15.00	18.00	.....	24.00	30.00	39.00	54.00	.....	.....
Du Page.....	Naperville.....	11.00	15.00	19.00	.....	30.00	45.00	60.00	.....	.....	.....
.....	Lombard.....	11.00	.....	19.00	.....	28.00	45.00	60.00	.....	100.00	115.00
Edgar.....	Paris.....	.....	.....	23.45	.....	31.25	40.20	50.25	67.00	.....	.....
.....	Kansas.....	.....	.....	18.00	.....	24.00	36.00	45.00	54.00	.....	.....
Ford.....	Paxton.....	10.00	.....	12.50	.....	18.00	30.00	40.00	.....	.....	.....
Fulton.....	Farmington.....	15.00	.....	20.00	25.00	30.00	40.00	50.00	.....	.....	.....
Gallatin.....	Ridgeway.....	15.00	.....	20.00	.....	25.00	30.00	35.00	45.00	.....	.....
Greene.....	White Hall.....	.....	10.00	15.00	.....	20.00	30.00	40.00	60.00	75.00	.....
.....	Barrow.....	10.00	.....	15.00	.....	25.00	35.00	50.00	70.00	100.00	.....
.....	Athensville.....	.....	.....	13.00	.....	20.00	30.00	40.00	.....	.....	.....
Grundy.....	Morris.....	11.00	.....	18.00	.....	28.00	45.00	60.00	.....	.....	.....
Hancock.....	Hamilton.....	15.00	.....	20.00	.....	30.00	40.00	50.00	60.00	75.00	100.00
.....	La Harp.....	.....	.....	20.00	.....	32.00	40.00	.....	.....	.....	.....
Iriquois.....	Watseka.....	.....	.....	15.00	.....	20.00	30.00	40.00	.....	.....	.....
.....	Milford.....	.....	.....	15.00	.....	20.00	30.00	40.00	.....	.....	.....
.....	Milford.....	.....	7.50	10.00	12.50	18.00	25.00	32.00	.....	56.00	.....
Kane.....	Aurora.....	11.00	.....	19.00	.....	30.00	45.00	60.00	75.00	95.00	.....
Kendall.....	Millington.....	11.00	.....	19.00	.....	30.00	45.00	60.00	.....	.....	.....
Knox.....	Maquon.....	.....	14.00	18.00	.....	28.00	35.00	45.00	.....	.....	.....
.....	London Mills.....	.....	.....	18.00	.....	27.00	36.00	.....	.....	.....	.....
.....	Knoxville.....	13.00	14.00	17.00	.....	29.00	40.00	50.00	60.00	70.00	.....
Livingston ..	Fairbury.....	.....	.....	15.00	18.00	23.00	30.00	40.00	.....	.....	.....
.....	Forest.....	.....	14.00	16.00	20.00	25.00	35.00	.....	.....	.....	.....
Logan.....	Atlanta.....	12.50	.....	15.00	.....	25.00	35.00	45.00	.....	75.00	.....
.....	Atlanta.....	.....	12.50	15.00	.....	25.00	35.00	45.00	60.00	75.00	.....
.....	Lincoln.....	.....	12.00	18.00	.....	25.00	36.00	48.00	65.00	80.00	.....
.....	Lincoln.....	.....	.....	17.00	.....	24.00	35.00	47.00	69.00	.....	.....
.....	Lincoln.....	11.00	.....	17.00	.....	24.00	35.00	47.00	69.00	.....	.....
Macon.....	Blue Mound.....	.....	10.00	15.00	.....	20.00	30.00	40.00	50.00	.....	.....
.....	Decatur.....	.....	12.50	15.00	.....	20.00	30.00	40.00	.....	.....	.....
.....	Argenta.....	.....	14.00	20.00	.....	25.00	35.00	45.00	.....	.....	.....
.....	Blue Mound.....	.....	10.00	16.00	.....	22.00	32.00	40.00	.....	.....	.....
Macoupin.....	Viriden.....	.....	12.00	15.00	.....	25.00	35.00	45.00	65.00	75.00	.....
.....	Palmyra.....	.....	.....	15.00	.....	25.00	35.00	50.00	.....	80.00	.....
Madison.....	Alton Junction.....	12.00	.....	16.00	.....	24.00	.....	45.00	.....	.....	.....
Marshall.....	Sparland.....	.....	12.00	15.00	18.00	20.00	30.00	40.00	.....	.....	.....

Price per 1000 feet of Drain Tile at Factories—1878.—Continued.

COUNTY.	POST OFFICE.	2 inch.	2½ inch.	3 inch.	3½ inch.	4 inch.	5 inch.	6 inch.	7 inch.	8 inch.	9 inch.
McDonough..	Bardolph.....	\$12.00	\$15.00	\$18.00	\$.....	\$27.00	\$42.00	\$52.00	\$70.00	\$100.00	\$.....
McLean.....	Saybrook.....	.....	13.00	15.00	.....	22.00	32.00	45.00	.....	.....	.....
"	Padua.....	.....	13.00	15.00	.....	22.00	32.00	45.00	.....	.....	.....
"	Hendrix.....	.....	.....	15.00	16.00	20.00	30.00	45.00	.....	.....	.....
Menard.....	Athens.....	.....	.....	14.00	18.00	24.00	35.00	45.00	.....	.....	.....
"	Petersburg.....	.....	10.50	13.50	.....	21.00	31.00	49.00	70.00	.....	.....
Mercer.....	Aledo.....	13.00	.....	18.09	.....	27.00	36.00	50.00	.....	.....	100.00
Morgan.....	Chapin.....	.....	12.50	15.00	.....	25.00	35.00	50.00	.....	.....	.....
"	Woodson.....	11.00	13.00	18.00	.....	28.00	38.00	55.00	75.00	100.00	.....
"	Jacksonville.....	.....	12.00	15.00	20.00	25.00	35.00	50.00	80.00	.....	.....
Peoria.....	Summerville.....	12.00	.....	18.00	.....	30.00	40.00	50.00	.....	.....	.....
"	French Grove.....	15.00	.....	20.00	.....	70.00	40.00	50.00	.....	.....	.....
"	French Grove.....	.....	15.00	20.00	.....	30.00	40.00	50.00	60.00	85.00	.....
"	Monica.....	13.50	.....	18.00	.....	27.00	36.00	50.00	.....	.....	.....
Pike.....	Pittsfield.....	10.00	12.50	15.00	.....	24.00	35.00	50.00	.....	.....	.....
"	Milton.....	.....	14.00	17.00	.....	27.00	36.00	50.00	.....	.....	.....
"	Milton.....	10.00	.....	15.00	.....	25.00	35.00	50.00	.....	.....	.....
"	Barry.....	13.00	.....	15.00	.....	25.00	35.00	50.00	.....	.....	.....
Sangamon.....	Buffalo.....	.....	13.00	15.00	.....	22.00	32.00	42.00	55.00	65.00	.....
"	Springfield.....	.....	12.00	14.00	.....	20.00	30.00	40.00	.....	.....	.....
"	Springfield.....	.....	.....	15.00	.....	22.00	32.00	42.00	.....	65.00	.....
"	Auburn.....	.....	12.50	15.00	22.50	25.00	35.00	50.00	.....	.....	.....
Schuyler.....	Rushville.....	12.00	.....	17.00	.....	26.00	35.00	50.00	.....	.....	.....
"	Ray.....	13.00	15.00	18.00	.....	28.00	38.00	55.00	.....	.....	.....
Scott.....	Winchester.....	.....	12.50	15.00	.....	25.00	35.00	50.00	.....	100.00	.....
"	Alsey.....	12.00	.....	15.00	.....	26.00	35.00	55.00	.....	100.00	.....
Shelby.....	Windsor.....	9.00	.....	12.00	.....	18.00	24.00	33.00	.....	.....	.....
Stark.....	Wyoming.....	12.00	.....	15.00	.....	22.00	30.00	40.00	60.00	70.00	.....
"	Lafayette.....	.....	13.50	17.00	.....	26.00	36.00	50.00	.....	.....	.....
Tazwell.....	Pekin.....	12.00	.....	16.00	19.00	23.00	33.00	43.00	.....	.....	.....
"	Minier.....	.....	.....	15.00	20.00	22.50	30.00	45.00	60.00	80.00	.....
"	Hopedale.....	.....	.....	14.00	18.00	22.00	30.00	45.00	.....	.....	.....
"	Morton.....	.....	.....	17.50	.....	27.50	37.00	55.00	.....	75.00	.....
"	Hopedale.....	.....	.....	15.00	18.00	20.00	30.00	45.00	.....	.....	.....
"	Delaven.....	10.00	.....	14.00	.....	22.00	30.00	45.00	60.00	75.00	.....
"	Washington.....	.....	15.00	17.50	22.50	27.50	37.50	55.00	.....	.....	.....
"	Minier.....	12.00	.....	15.00	18.00	22.00	35.00	45.00	.....	70.00	.....
Vermilion.....	Rossville.....	10.00	.....	20.00	.....	25.00	30.00	40.00	50.00	.....	.....
"	Georgetown.....	10.00	.....	12.00	16.00	.....	20.00	30.00	40.00	.....	.....
"	Ridge Farm.....	.....	.....	18.00	.....	28.00	38.00	48.00	.....	.....	.....
"	Vermilion Grove.....	.....	.....	15.00	.....	20.00	30.00	40.00	.....	.....	.....
"	Indianola.....	.....	.....	12.50	.....	18.00	27.00	35.00	45.00	.....	.....
"	Potomac.....	.....	12.50	16.50	.....	22.50	32.50	42.00	.....	60.00	.....
White.....	Grayville.....	.....	15.00	24.00	25.00	27.30	42.45	54.60	.....	91.00	.....
Woodford.....	Low Point.....	.....	13.50	18.00	.....	27.00	36.00	45.00	60.00	75.00	.....
"	Secor.....	9.00	.....	15.00	20.00	25.00	35.00	45.00	.....	.....	.....

TILE MANUFACTURERS.

NAME.	Post Office.	County.	NAME.	Post Office.	County.
Nolen Bro's.....	Mound Sta'n.	Brown.	Lemon & Scott.	Blue Mound	Macon.
Walton Bro's.....	Princeton...	Bureau.	J. Willard & Co....	Blue Mound	"
M. Smith.....	Homer.....	Champ'gn	J. W. Ott & Co....	Viriden.....	Macoupin.
C. A. Nebecker.....	Mahomet...	"	R. Tucker.	Palmyra ...	"
Dickey & Randolph.	Pana.....	Christian.	*A. S. P. & F. B. W.	Alton Junc.	Madison.
J. L. Turner.....	Taylorville..	"	Dawson & Co.....	Sparland..	Marshall.
A. Whitmack.....	Edinburg...	"	†B. F. C. Works....	Bardolph...	McDon'g.
T. J. Bernard.....	Pana.....	"	N. B. Heafer & Son..	Bloomington	McLean.
J. M. Pike.....	Rosemond...	"	B. R. Wirt.....	Saybrook...	"
J. B. Carter & Co..	Ashmore....	Coles.	Stoops & Co.....	Padua	"
S. H. Record & Co..	Charleston..	"	Wm. C. Waldon....	Hendrix....	"
G. V. Miller.....	Mattoon ...	"	C. Clark.....	Athens....	Menard.
R. W. McClelland ..	Mattoon ...	"	Bale & Co.....	Petersburg.	"
J. W. Hogue.....	Mattoon ...	"	B. F. Townsly	Aledo.....	Mercer.
J. D. Farris.	Charleston..	"	Coons & Co.....	Chapin	Morgan.
Ncal & Foss.....	Farmer City.	DeWitt.	Wm. P. Craig.....	Woodson ..	"
Chas. Richter.....	De Witt.....	"	Robt. Smith Jr....	Jacksonville	"
Traver and Reeser..	Kenney.....	"	R. G. McCulloch...	Summ'rville	Peoria.
F. C. Davidson.....	Clinton.....	"	Lawson & Tucker..	Frnch Grove	"
R. C. Patterson....	Camargo....	Douglas.	J. S. Tucker.....	"	"
H. M. Toomey.....	Arcola.....	"	A. W. Bushnell....	Monica.....	"
Martin & VanOven.	Naperville..	Du Page.	Fred. Kespohl....	Pittsfield..	Pike.
W. Hammerschmidt.	Lombard....	"	Fred. Hudson....	Milton.....	Pike.
W. E. Hay.....	Paris.....	Edgar.	Chas. H. Chilton...	Barry	Pike.
J. S. Paxton.....	Kansas.....	"	Argilla Works.	Carbon Cliff	Rock Is'd.
Thos. Paxton.....	Kansas.....	"	†E. & H.....	Buffalo....	Sangamon
S. Lundburg.....	Paxton.....	Ford.	Grubb & Donner....	Springfield	"
A. Keeling & Son..	Farmington.	Fulton.	Govia & Peaker....	Springfield	"
Smith & Kinnada....	Ridgway....	Gallatin.	Dawson & Reader..	Auburn....	"
Culbertson & Smith.	White Hall ..	Greene.	John McCabe.....	Rushville...	Schuyler
‡W. F. C. Works....	White Hall ..	"	Hooper & Co.....	Ray.....	"
Dunn & Bruce.....	Barrow	"	Coons Bros.....	Winchester.	Scott.
§P. Bros. & M.....	Athensville ..	"	C. A. Watt & Co....	Alsey.....	"
Buck & Martin.....	Morris.....	Grundy.	S. E. Spraker.....	Windsor....	Shelby.
N. & F. D. Lyon...	Hamilton...	Hancock	**McC. & C.....	Wyoming...	Stark.
E. A. Saunders....	Geneseo....	Henry.	Todd & Cecil.....	LaFayette ..	"
Zimri Hockett....	Watseka....	Iriquois.	C. C. Young.....	Pekin.....	Tazwell..
Beach & Owen.....	Del Rey	"	Wm. G. Stafford....	Minier.....	"
George Hix.....	Milford	"	Robert Hudson&Co	Hopedale...	"
Ira Brown.....	Milford	"	M. Rapps Bros....	Morton.....	"
Griswold & Gillett..	Aurora	Kane.	W. Brennerman....	Hopedale...	"
Millington Tile Co..	Millington ..	Kendall.	Robert & Franklin.	Davenport..	"
Wm. H. Beeson....	Maquon	Knox.	Peter Switzer.....	Washington	"
T. J. Routh.....	Londn Mills.	"	W.O.Goltfelter&Son	Minier.....	"
Wm. Jones.....	Knoxville ..	"	Armstrong Jenkins	Rossville...	Vermilion
R. C. Straight.....	Fairbury....	Livingstn	Chas. Mitcnell....	Georgetown	"
Francis Bros.....	Forrest	"	Wm. Lorraine.....	Ridge Farm	"
John H. Dowson....	Atlanta....	Logan.	Jesse Gibson.....	VermillionG	"
R. Brandt.....	Atlanta....	"	Wm. H. Adams....	Indianola ..	"
Alvis Ganz.....	Lincoln....	"	Postle & Barril....	Potomac....	"
Lincoln Tile Works.	Linclon....	"	M. M. & M'f'g Co:	Monmouth..	Warren
Bosworth & Willard	BlueMound ..	Macon.	Patton Bros.....	Monmouth..	"
Charles Lewis.....	Decatur....	"	Endicott & Williams	Crossville...	White.
Martin & Gillen....	Decatur....	"	W.G.Wheatcroft&Co	Grayville...	"
Reeser & Weiman...	Argenta....	"	J.M.Pinkerton&Son	Low Point.	Woodfrd
Kepler & Hulsebur.	Wa'rensburg	"	Lowrey & Cook....	Secor.	"
D. W. Allinson....	Macon.....	"			

*Alton Sewer Pipe and Fire Brick Works.

†Bardolph Fire Clay Works.

‡Eymann & Hugenberger.

‡White Hall Fire Clay Works.

§Pepperdine Bros. & Morrow.

**McCullough & Cammehon,

IMPORTANT RESULTS FROM DRAINAGE.

[From the "*Handy Book of Husbandry*," by George E. Warring, Newport, R. I.
See pages 95, 96, 97, 98.]

1. *It greatly lessens the evil effects of drought.* During the hottest weather there is a great amount of water in the atmosphere, which has been evaporated from the earth by heat, and which is held by heat in the form of vapor. When this vapor comes in contact with bodies sufficiently cooler than itself they take away its heat, and the vapor contracts to the liquid form (condenses) and is at once deposited as dew on the surface of the cooler substance. At night, after a hot summer day, the earth is much cooler than the air, consequently, as it absorbs heat from the atmosphere and from the watery vapor contained in the air, dew is deposited. The familiar example of a cold pitcher, which seems to sweat in hot weather, while it is only absorbing heat from the air and causing the vapor of the air to be deposited in a liquid form, is an illustration of this law of condensation. In like manner a knife-blade condenses dew from the breath by depriving the moisture in the breath of its heat and thus causing it to assume the liquid form. So, when the water is removed from the soil, the spaces between its particles (which, before drainage, had been filled with water) are occupied by air, and, to a greater or less extent—owing to the motion of the air above the surface caused by winds, and to the effect of changes of temperature below the surface—this air is constantly changing, and that which enters from above charged with vapor gives up its heat and therefore the moisture, both of which are absorbed by the lower and cooler soil. In consequence of this action—especially where the surface of the soil is kept in a loose condition, so as to admit air freely—drained lands withstand drought better than those which are undrained.

2. *It enables the soil to receive a larger supply of the fertilizing gases of the atmosphere (carbonic acid and ammonia).* The air always contains more or less of these gases, which with water are the chief sources of the materials of which plants are made. When the water which fills the spaces between the particles of the soil is drawn off, air enters and takes its place, and the carbonic acid and ammonia are absorbed, ready to be taken up by the roots of the plants and to produce beneficial changes in the mineral ingredients of the soil.

The rain which falls, finding the soil in a porous condition, sinks into it, and gives up the gases which it contains, passing out of the drains

nearly pure, while, if the land were already saturated, or had not been made porous by the process of draining, the water would, to a greater or less extent, run off over the surface, and instead of enriching the soil, would carry away some of its more fertile parts.

3. *It warms the lower portions of the soil.* We have already seen (1) that the air which circulates in the soil gives up heat, and it thus elevates the temperature of those parts which are cooler than the atmosphere. The water of rains also, in passing down through the soil, carries with it the heat of the surface and deposits it, and a portion of the heat which it received from the warm air through which it fell, in the lower and cooler parts of the soil. In hot weather the water which issues from the mouth of a drain is often ten degrees cooler than that which falls on the surface, and all of its lost heat has been given to the soil.

4. *It lessens the cooling of the soil by evaporation.* This is one of the most important effects of draining. When liquid water becomes vapor it increases in bulk 1723 times, and it contains 1723 times as much heat. The heat required to evaporate it is taken from surrounding substances. When water is sprinkled on the floor it cools the rooms because in becoming a vapor (drying) it takes heat from the room. If a wet cloth be placed on the head, and the evaporation of its water assisted by fanning, the head becomes cooler, a portion of its heat being taken to convert the water into the condition of vapor.

The same action takes place in the soil. When the evaporation of its water is rapidly going on, by the aid of the sun and wind, heat is abstracted and the soil becomes cold. If the water of the soil is mainly removed by draining there is comparatively little to be evaporated and comparatively little heat is taken away, probably not more than is received from the atmosphere. (3). This cooling of the soil by the evaporation of its water greatly retards the growth of crops, and the fact that draining lessens evaporation is one of the strongest arguments in favor of its adoption. An idea may be formed of the amount of heat taken from the soil in this way from the fact that in midsummer twenty-five hogsheads of water may be evaporated from a single acre in twelve hours.

5. *It greatly facilitates the chemical action by which the constituents of the soil are prepared for use of plants, and by which its mechanical texture is improved.* Ordinary soils contain roots and other organic matter, and the various minerals which aid, directly or indirectly, in the nutrition of plants. Before the roots, etc., which have been left in the soil by a previous crop, can become useful to a new growth they must undergo the process of decay, which is a slow combustion, requiring the action of atmospheric air. In a soil saturated with water this decay cannot take place. It proceeds most actively in thoroughly drained land, while in land which is often too wet it is greatly retarded.

The mineral constituents of plants can be taken up by roots only in solution of water, which can dissolve them only from the surfaces of the particles of the soil, and usually only after they have undergone a chemical change from exposure to the air and moisture. The more freely air is admitted into the soil the more easily will the coarse particles be

disintegrated, thus exposing more surface, and the more readily will the exposed portions be prepared for the dissolving of their fertilizing ingredients. These chemical changes also greatly improve the mechanical condition of the soil, tending to make it more light and friable, both from the greater fineness and from the increased amount of its decayed organic matter, to enable it more readily to absorb fertilizing gases from the air and from rains and to condense the watery vapor of the atmosphere in dry weather.

6. *It tends to prevent grass lands from "running out."* The tillering of grasses—that process by which they constantly reproduce themselves by offshoots from the crowns of the plants—goes on during the season of growth, as long as the roots can find sufficient nutriment in the soil, unless arrested by their coming in contact with a cold, wet, uncongenial subsoil. By withdrawing the moisture which causes this unfavorable condition of the subsoil we may maintain a full supply of grass plants as long as we can keep the soil rich enough to support them.

7. *It deepens the surface soil.* The withdrawal of the water, which, in undrained lands, occupies the subsoil for so great a portion of the growing season, allows the roots of plants to extend much farther from the surface, and in decay, these roots deposit carbon (black mould) in the spaces of the lower soil, while the mineral parts are improved by the action of the air, thus gradually converting the subsoil to the condition of the surface soil.

8. *It renders soils earlier in the spring and keeps off the effects of cold weather longer in the fall,* because the water which renders them cold, heavy and untillable, is earlier removed, and the excess of water, which produces an unfertile condition, on the first approach of cold weather, is withdrawn.

9. *It prevents the throwing out of grain in winter,* because the water of rains is at once removed instead of remaining to throw up the surface by freezing, as it does by reason of the vertical position taken by the particles of ice.

10. *It enables us to work much sooner after rains,* inasmuch as the water will pass down to the level of the drains much sooner than it will soak away in an undrained, retentive soil, or be removed by slow evaporation from the surface of the ground.

11. *It prevents land from becoming sour,* because the acids which result from the decay of organic matter, in the presence of too much moisture, are not formed in the more healthy decomposition which takes place in a sufficiently dry and well-aerated soil.

12. *It lessens the formation of a crust on the surface of the soil after rains in hot weather.* When water having mineral matters in solution is drawn up from the lower soil it deposits them, at the point of evaporation, at the surface, after forming a hard crust, which is a complete shield, to prevent the admission of air with its fertilizing gases and water vapor. In proportion to the completeness with which the water of rains is removed from below do we lessen the evaporation by which this crust is so largely formed.

DRAINAGE LAWS.

CONSTRUCTION, MAINTENANCE AND REPAIRS OF DRAINS AND DITCHES BY SPECIAL ASSESSMENT.

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CONSTRUCTION, MAINTENANCE AND REPAIR OF DRAINS AND DITCHES BY SPECIAL ASSESSMENT.

AN ACT to provide for the organization of Drainage Districts and to provide for the construction, maintenance and repair of drains and ditches, by special assessments on the property benefited thereby. Approved May 29, 1879; in force July 1, 1879.

SECTION 1. [DRAINAGE COMMISSIONERS.] *Be it enacted by the people of the State of Illinois, represented in the General Assembly, That the Commissioners of Highways in every township in the several counties under township organization, in this State, shall be the Drainage Commissioners in and for their respective townships*

and as such shall be a body politic and corporate, and be the corporate authorities of drainage districts within their townships, may sue and be sued, and exercise all the powers and perform all the duties hereinafter set forth. In all legal proceedings begun and carried on under the provisions of this act, their corporate name shall be the Drainage Commissioners of (name of township) township, (name of county) county, and State of Illinois.

§ 2. [CLERK OF COMMISSIONERS—DUTIES.] The town clerk shall be the clerk of the drainage commissioners, he shall be the custodian of all papers and records pertaining to drainage matters in his township, and shall keep in a well bound book to be known as the Drainage Record, a record of the proceedings of the commissioners, and shall enter at length therein, all the findings and orders of the commissioners pertaining to the subject of drainage.

§ 3. [DRAINAGE DISTRICT—HOW ORGANIZED—PETITION.] The following proceedings shall be taken for the purpose of organizing a drainage district. A petition shall be presented to the town clerk, signed by a majority in number of the adult owners of lands lying in said proposed district, and they shall be the owners in the aggregate of more than one-third of the lands lying in said district, setting forth the boundaries of said district, giving the numbers of sections or fractional parts thereof. Said petition shall state that the lands lying within the boundaries of said proposed district require a combined system of drainage or protection from overflow; that the petitioners desire that a drainage district may be organized embracing the lands therein mentioned, for the purpose of constructing, repairing or maintaining a drain or drains, ditch or ditches, within said district, for agricultural, sanitary or mining purposes, by special assessments upon the property benefited thereby. Said petition shall be accompanied by a bond to the drainage commissioners, signed by at least two responsible persons, conditioned for the payment of all costs occasioned by said proceedings, in case said district shall not be organized.

§ 4. [FILING PETITION—NOTICE OF MEETING.] It shall be the duty of the town clerk to file said petition in his office, and he shall within five days after the filing of said petition, give notice in writing to each of the commissioners of highways of such town, of the filing of such petition, and shall give notice by posting written or printed notices, in at least six public places in said township, that a meeting of the drainage commissioners will be held at such place and time as the commissioners may decide upon, not less than eight days nor more than fifteen days from the date of said notice, for the purpose of organizing said drainage district. He shall file a copy of said notice in his office.

§ 5. [HEARING—EVIDENCE—FINDING.] It shall be the duty of the drainage commissioners to meet at the time and place mentioned in said notice, and the clerk shall lay before them the said petition and all other papers in the case, and they shall thereupon proceed to ascertain whether the said petition contains the signatures of a majority of the adult persons owning land in said district, and if they are all owners of more than one-third of the land situate in said district; and the affidavits of two or more credible signers of said petition that they have examined the same, are acquainted with the locality of the district, and that they believe that said petition is signed by a majority of the adult owners of land in said district, and that said signers are the owners of more than one-third of the lands in said district, the same may be taken as *prima facie* evidence of the facts set forth in said petition as against the owners of lands in said district, and as conclusive evidence against all persons signing said petition, that they have accepted the provisions of this act as to the assessments of benefits and damages hereunder. At such meeting, any other owners of land within said district shall be permitted to place their names on said petition, if they so desire. Any person owning land in said district, whose name does not appear on said petition, may, at said time and place, appear and controvert any material statement in said petition; and any person who has signed said petition may deny or withdraw his signature thereto, on payment of his proportion of costs incurred to that date, and for the purposes of such hearing, the said officers shall have full power to administer oaths to and examine all witnesses produced, and shall decide all such controverted questions at such time and place, and make a written statement of their finding, to be filed with the papers in the case.

§ 6. [DISMISSAL OF PETITION.] If the commissioners shall find that the pet

tion has not been signed by a majority of the adult owners of land situated in said proposed district, or that the signers of said petition do not own more than one-third of the lands in said district, they shall so decide, and the petition shall be dismissed at the cost of the petitioners, which costs shall be apportioned among the petitioners according to acreage of their lands respectively situated in said district. But such apportionment shall not prevent the commissioners from collecting such costs from the sureties required in section three of this act.

§ 7. [WRITTEN STATEMENT OF FINDING.] If the commissioners shall find that the petition is signed by a majority of the adult persons owning lands in said proposed district, and that the signers own more than one-third of the lands situated therein, they shall so decide, and shall make a written statement of their finding, and shall file said statement with the other papers in the case, and the clerk shall enter the same in his record; *Provided*, that if the commissioners shall fail to complete their investigations on the day of meeting, they may adjourn to another day, not more than three days from such first day, and may, for good cause shown, again adjourn in like manner, until such investigation is concluded.

§ 8. [ADJOURNMENT—EXAMINATION OF LAND—PLAT—ESTIMATES.] If the commissioners shall find in favor of the petitioners, as set forth in the last preceding section, they shall then adjourn their meeting to a time not less than eight days nor more than fifteen days, of which time the clerk shall give notice. The commissioners shall, in the meantime, go upon the lands included in the proposed district, and personally examine the same; and they shall have power to employ a competent civil engineer, if in their opinion the services of an engineer be necessary, who shall thereupon, proceed to make such survey and estimates as the said commissioners may direct, and shall make and return to the said commissioners a map or plat of his survey, and a full report of all estimates so required of him.

§ 9. [ORGANIZATION OR DRAINAGE DISTRICT.] At the time appointed for the adjourned meeting, the commissioners shall meet and examine the map and report of the engineer, if any engineer shall have been employed, and if from their own examination and said map and report if any there be, it shall appear that the lands included in the proposed district will be benefited for agricultural, sanitary or mining purposes by the construction of a drain, or a combined system of drainage, they shall so find; unless they shall find from the evidence of witnesses then introduced that the cost of the proposed work will exceed the benefits to be derived therefrom. And should they find in favor of the petitioners, or should a two-thirds ($\frac{2}{3}$) majority of the owners of land, owning more than one-half ($\frac{1}{2}$) of the lands lying in said proposed district, still desire the formation of said district, and such desire shall be evidenced by a failure to withdraw their signatures from the petition, the commissioners shall enter on their record an order in writing organizing said drainage district, and such district shall thereupon be declared fully organized. Each district shall be designated by a number, as District No. . . , in . . township, . . county, and State of Illinois.

§ 10. [COMMISSIONERS TO LOCATE PROPOSED WORK—MAPS.] Upon the organization of any drainage district as above provided, it shall be the duty of the commissioners to go upon the lands included in such district, and locate the work proposed to be constructed, repaired or maintained, and shall make or cause to be made a map or plat of the work necessary to be done, which map, shall be signed by the commissioners or a majority of them, and shall be recorded in the Drainage Record.

§ 11. [RIGHT OF WAY—DAMAGES.] The commissioners shall then proceed to procure the right of way for said work from the owners of the land upon which the same may pass, so far as they can do so by agreement with said owners, which release or releases of right of way shall be in writing, and shall be a perpetual bar to all claims for damages by the grantor or grantors or their assigns, on account of the construction of such work. Such release or releases shall be filed in the town clerk's office, and he shall cause the same to be recorded in the office of the recorder of deeds in and for the county in which said lands are situated: *Provided*, that should the commissioners be compelled to pay damages for the right of way in any lands over which any work may run by virtue of the finding of a jury called to assess damages, as hereinafter provided, that then and in that case they shall allow damages equitably to other owners of lands through which such work may be located, not-

withstanding such owners may have released such right of way without adequate compensation.

§ 12. [DAMAGES ASSESSED BY JURY—VENIRE—NOTICE TO OWNERS.] Should the commissioners be unable to procure the right of way by agreement with the owner or owners of any lands over which the work may be located, they shall file a statement in writing with some justice of the peace in the vicinity, requesting him to issue a *venire* for a jury to assess the damages in such case or cases; and it shall thereupon be the duty of the justice to issue a *venire* for a jury of six disinterested freeholders, to appear at his office at a day and hour therein named, not less than five nor more than eight days therefrom, for the purpose of assessing the damages in the case or cases mentioned. The justice shall at the same time cause a notice or notices in writing to be served upon the owner or owners of the lands in question, informing him or them of the time and place when the said case or cases will be tried. Said notices may be substantially in the following form:

To A. B. . . . You are hereby notified that a jury has been called to meet at my office in . . . township, . . . county, on the . . . day . . . of . . . A. D. 18 . . . at . . . o'clock, . . . M., for the purpose of assessing damages in the matter of the Drainage Commissioners of . . . township . . . county, against you; when and where you can appear and assert your rights in the premises if you desire.

C. S. J. P.

Said notice shall be served by a constable in the same manner and with like effect as process in civil cases, and his return thereon shall show the manner such service was made, and for such service he shall be allowed the same fees as for service of process in civil cases; *Provided*, that where it shall be made to appear that any of such owners are non-resident, unknown, or minors, notice of such proceeding shall be given by publication in some newspaper published in said county, for two successive weeks prior to the time of such hearing, which notice shall be substantially in the form given above; *Provided, further*, that in any case where the commissioners certify that the damages will probably exceed two hundred dollars (\$200), the proceedings shall be begun in the county court.

§ 13. [TRIAL—VERDICT—TRANSCRIPT TO BE FILED.] When the jury shall appear, as provided in the foregoing section, the trial shall be conducted as other cases before a justice of the peace, or county court, as the case may be; either party may have the same number of challenges and for the same causes as in other cases before justices of the peace, or the county court, as the case may be. The jury shall hear the evidence offered in the case as to the value of the land proposed to be taken, and all damages consequent upon the construction of the proposed work; and may go upon the premises for the purpose of viewing them, and they shall return as their verdict the amount of damages found, if any, in favor of the owner or owners, and against the commissioners, and the justice of the peace, or county judge, shall enter judgment for the amount of such verdict, which judgment shall be final and conclusive. Vacancies in the panel of jurors shall be filled the same as vacancies in other cases, but vacancies shall in all cases be filled by freeholders, and the same jury shall hear and determine all cases for which the *venire* was issued, and shall return separate verdicts as to each owner or joint owners. And the justice or judge shall thereupon file in the office of the clerk of the drainage commissioners a certified transcript of the proceedings before him in each case.

§ 14. [COMMISSIONERS TO VIEW LANDS—BENEFITS ASCERTAINED—ASSESSMENT.] At the earliest practicable day after the organization of the district, the commissioners shall proceed to view the line or lines of the proposed work and determine the cost of the same, and shall view the lands to be benefited thereby, and ascertain, to the best of their judgment, the amount of the benefits which will accrue to each tract of land to be affected thereby, and shall assess to each tract of land its proportionate share of the entire cost of such work; but in no event shall any tract of land be assessed for benefits in a greater amount than its proportionate share of the estimated cost of the work and all expenses of proceedings, nor in a greater amount than it will be benefited by the proposed work according to the best judgment of the commissioners; and they shall make out and file in the office of the town clerk an assessment roll, in which shall be set down in proper columns the names of the own-

ers, when known and when unknown, stating "unknown," a description of the premises affected, in words or figures, or both, as shall be most convenient; the number of acres in each tract, the amount of land taken from such tract, and the value thereof; and if damages are allowed, the amount of the same; and if benefits are assessed, the amount of the same; and in case damages are allowed to and benefits assessed against the same tract of land, the balance, if any, shall be carried forward to a separate column for damages or benefits, as the case may be.

§ 15. [FORMER DITCH MAY BE UTILIZED.] When it shall appear to the commissioners that a drain, or ditch has been, in whole or in part, previously constructed for the purpose of draining or protecting from overflow any land to be affected by the work proposed under this act, and such original work can be advantageously utilized, they may estimate the value of such old ditch, and allow the owner such part thereof as will make an equality of burdens and benefits as between the several owners of lands in the said district.

§ 16. [NOTICE OF MEETING TO HEAR OBJECTIONS.] The commissioners shall cause to be personally served upon all parties owning land to be affected by the proposed work, and residing in the county, a written or printed notice of the time when and place where they will meet to hear any and all objections that may be made to their special assessments for benefits, and shall cause to be sent, by mail, such notice to all owners who do not reside in the county, whose land is to be affected, in case their post-office address is known to petitioners, or any of them, or can be ascertained by use of reasonable diligence; and in case the land of any non-resident or minor is to be affected, then publication shall be made in some newspaper published in said county, for three successive weeks prior to the time of such hearing.

§ 17. [PROOF OF NOTICE.] The affidavit of any credible person or persons that he has or they have posted such notices hereinbefore required, and the certificate of the publishers of such newspaper as to such publication, shall be sufficient evidence of such facts.

§ 18. [ASSESSMENT—CORRECTION—CONFIRMATION—APPEAL TO SUPERVISORS—BOND.] At the time of meeting for hearing objections to the special assessments made by the commissioners, they shall hear whatever objections may be urged by any person interested, to any special assessment made by the commissioners, and if satisfied that any injustice has been done in any special assessment, they shall correct the same in accordance with justice and the right of the matter; but if not so satisfied, they shall confirm the assessment as originally made, and enter an order to that effect. Any person appearing and urging objections, who is not satisfied with the decision of the commissioners in confirming a special assessment against his lands, may appeal from the decision of the commissioners to three supervisors of the county, within ten days after the decision of the commissioners has been rendered, by filing with the town clerk a bond, with security, in double the amount of the assessment, payable to the commissioners, conditioned for the payment of the assessment and all costs occasioned by the appeal, in case said assessment shall be affirmed.

§ 19. (SUMMONS TO SUPERVISORS TO HEAR APPEAL.) It shall be the duty of the town clerk to summon three supervisors of the county living nearest the office of the town clerk, but outside his township, to meet at his office at a time not more than ten days from the filing of the appeal bond for the purpose of hearing any appeal or appeals that may be taken from the decision of the commissioners. Should any of said supervisors fail to appear at the time named, the clerk may adjourn said meeting for a period not exceeding five days, and summon another supervisor or supervisors to fill the vacancy or vacancies.

§ 20. (HEARING—JUDGMENT—APPEAL TO COUNTY COURT.) Whenever the supervisors summoned to hear appeals shall all appear as heretofore provided, it shall be the duty of the town clerk to lay before them the assessment roll, and they shall examine the same, and may hear testimony in support of such assessment appealed from and in opposition to the same, and may, if they deem it necessary, visit the lands upon which assessments have been made. Should the supervisors, after hearing the case, affirm the action of the commissioners, they shall file with the clerk their decision to that effect. Should they deem the assessment excessive, they may enter an order remitting such portion of such assessment as they deem in excess of right; or should they deem the assessment wholly erroneous they may wholly annul

the same; and the clerk shall correct the assessment roll in accordance with the decision of the supervisors: *Provided*, that either party aggrieved by the decision of the supervisors may appeal to the county court by filing bond in the county clerk's office within ten days from the time when the supervisors render their decision, the party against whose land an assessment has been made shall appeal only, on the ground that such assessment is greater in amount than the benefits accruing to said lands by the construction of the proposed work. Should the commissioners appeal they may do so without giving bond. Should the person against whose lands an assessment has been made appeal, the bond shall be conditioned for the payment of whatever judgment shall be rendered against him in the county court.

§ 21. (HEARING APPEAL—COSTS.) Appeals taken to the county court under the provisions of this act may be heard at any term thereof: *Provided*, ten days has intervened from the time of taking such appeal and the first day of the term, and if not ten days, then such appeal shall be heard at the next term; and trials shall be conducted as in other cases of appeals. Should the decision of the supervisors be affirmed or wholly reversed, costs shall follow the judgment; but should such decision be modified, costs may be apportioned by the court in its discretion: *Provided*, that in any proceedings under this act, where any costs have been unnecessarily or improperly made, such costs may be adjudged against the party making the same.

§ 22. (APPEAL NOT TO DELAY PROGRESS OF WORK, ETC.) The taking of any appeal by any person or persons, as herein provided, shall not operate to delay the collection of any special assessment from which no appeal has been taken, nor delay the progress of the work.

§ 23. (ASSESSMENT—WHEN PAYABLE.) At the time of confirming such special assessment, it shall be competent for the commissioners to order the assessment of benefits to be paid in installments of such amounts and at such times as will be convenient for the accomplishment of the proposed work; otherwise, the whole amount of such assessment shall be payable immediately upon such confirmation, and shall be a lien upon the lands assessed until paid; and such assessment shall draw interest at the rate of eight (8) per cent. per annum from the time they shall become payable till they are paid, and such interest may be collected and enforced as part of the assessments.

§ 24. (COPY OF ASSESSMENT, CERTIFIED TO TREASURER—BOND.) Immediately after the entry of such confirmation of the special assessments, the clerk shall make out and certify to the treasurer a copy of said assessment roll; and the said treasurer shall execute bond to the people of the State of Illinois for the use of all persons interested, in a sum not less than twice the amount of assessments levied, conditioned for the faithful performance of his duties as treasurer of said drainage district, and that he will faithfully account for all money that, by virtue of said office, shall come to his hands; and such bond shall be with such sureties as may be approved by the commissioners, and said bond shall be kept and preserved in the town clerk's office.

§ 25. (TREASURER TO KEEP BOOKS.) It shall be the duty of said treasurer to keep proper books, furnished him by the commissioners, in which he shall keep an accurate account of all moneys received by him, and of all disbursements of the same; he shall pay out no money except upon the order of a majority of the commissioners, and shall carefully preserve on file all orders for the payment of money, given him by the commissioners, and shall turn over all books, papers, vouchers, moneys and property belonging to and in his hands, as such treasurer to his successor in office.

§ 26. (DIVISION OF WORK—LETTING CONTRACT.) The said commissioners, when they have procured the right of way for the proposed work, shall divide the ditch or ditches, into sections a quarter of a mile in length, except the remainder or remainders, after taking out as many full sections as the work contains, which remainder or remainders may be let with the adjoining section, or separately, as the commissioners may think best; or they may let the same in one contract: *Provided*, further, that no drain, ditch, or other work authorized to be constructed or made under this act, shall be constructed or made, in such a manner as to destroy or impair the usefulness, or prevent the public use of any bay or harbor, or body of water used as a harbor connected with any navigable stream.

§ 27. (NOTICE OF LETTING—ADVERTISING FOR PROPOSALS.) Upon the confirmation of the assessment, the commissioners shall cause notice to be given of the time and place of the letting, and of the kind and amount of work to be done, and where plans of the same may be seen, by publication for twenty days in some newspaper printed or published in said county. Said bids shall be under seal, and the commissioners may reject any and all bids, and may continue the letting from time to time if, in their judgment, the same be necessary. If the cost of the entire work will not exceed five hundred dollars (\$500), the commissioners shall let the same at such time and in such manner as they may think best. Said commissioners shall not, during their term of office, be interested, directly or indirectly, in any contract for the construction, repair or maintenance of any work in such drainage district, nor in the wages nor supplies to men or teams employed on any work under their jurisdiction. Any person or persons taking any work under contract shall, on the completion thereof, according to contract, be paid for such work by the treasurer, upon the order of the commissioners. If any person or persons to whom any portion of said work shall be let as aforesaid, shall fail to perform said work, the same shall be re-let in such manner as the commissioners may think best.

§ 28. (ASSESSMENT PAID IN LABOR.) In case any person assessed for benefits contracts to do any work, and said work is done according to contract, the commissioners shall give said person a receipt for so much said assessment as said work amounts to, and said receipt may be received by the treasurer as payment of so much of said assessment.

§ 29. (PAYMENT OF DAMAGES, RIGHT OF WAY, ETC.) All excess, if any, of allowances for right of way and damages, over the amount of special assessment for benefits against the same person, shall be paid or tendered to the owners thereof, before the commissioners shall be authorized to enter upon said lands for the construction of any work thereon; in case the owner is unknown, or there shall be a contest in regard to the ownership of the land, or the commissioners cannot, for any reason, safely pay the same to the owner, they may deposit the same with the clerk of the county court, and the court may order the payment thereof to such party as shall appear to be entitled to the same.

§ 30. (SUITS, ETC.) The commissioners may use money arising from the collection of assessments for the purpose of compromising suits and controversies arising under this act, and in employment of all necessary agents and attorneys in the prosecution or defense of said operations, and to pay all necessary employees.

§ 31. (ENTRY UPON LANDS.) The commissioners from the time of receiving any petition, may authorize any employes to go upon the lands lying within said district for the purpose of examining the same and making surveys; and after payment or tender of compensation allowed, may authorize all contractors with their servants, teams, tools, instruments, or other equipments for the purpose of constructing such proposed work, and may ever thereafter enter upon said lands as aforesaid, for the purpose of maintaining or repairing such work, doing no more damage than the necessity of the occasion may require, and any person who shall willfully prohibit or prevent any of the aforesaid persons from entering such lands for the purpose aforesaid, shall be fined in a sum not to exceed twenty-five dollars (\$25) per day, for such hindrance, to be collected as other fines.

§ 32. (ADDITIONAL ASSESSMENT.) When the assessments hereinbefore made shall be inadequate to complete the work proposed, or when assessments shall be necessary for maintenance and repair, each tract of land shall be assessed such proportion of the additional cost as its original assessment bore to the total original assessment, and the said additional assessment shall be made by the commissioners in the same manner as the original assessment was made; and in all subsequent matters in relation thereto, the same proceedings shall be had as hereinbefore required in regard to original assessments.

§ 33. (BRIDGES AND CULVERTS—HOW PAID FOR.) The commissioners shall have power and are hereby required to make all necessary bridges and culverts for the protection of ditches made hereunder; but said bridges and culverts shall be paid for as follows: When in a public highway, it shall be paid out of the road and bridge tax; and when in a farm, it shall be paid for by the drainage commissioner.

§ 34. (SUB-DISTRICTS.) During the progress of the work, or at any subsequent time the commissioners when petitioned to create a "sub-district," (within any district organized as aforesaid), for the purpose of constructing any lateral drain or drains for the further reclamation of lands within such "sub-district," by special assessment of the property benefitted thereby, shall be governed by the provisions of this act which are applicable thereto.

§ 35. (NOT TO PREVENT OTHER DRAINAGE.) Nothing in this act shall be construed to forbid or prevent the drainage of any lands, the drainage of which would require to be conducted to the same outlet through which the waters of any ditch constructed under this act shall flow.

§ 36. (PENALTY FOR INJURING, ETC.) Any person who shall wrongfully and purposely fill up, cut, injure, destroy, or in any manner impair the usefulness of any drain, ditch, or other work constructed, established, or lying within any district organized under this act for the purpose of drainage or protection against overflow, may be fined in any sum not exceeding two hundred dollars, to be recovered before a justice of the peace in the proper county. All complaints under this section shall be in the name of the people of the State of Illinois, and all fines, when collected, shall be paid over to the proper commissioners, to be used for the work so injured.

§ 37. (ACTION FOR DAMAGES.) In addition to the penalties provided in the preceding section, the person so wrongfully or purposely filling up or in any manner impairing the usefulness of any such drain or drains, shall be liable to the commissioners having charge thereof for all damages occasioned to such work, and to the owners and occupants of land for all damages that may result to them by such wrongful act, which may be recovered before a justice of the peace, if within his jurisdiction, or before any court of competent jurisdiction.

§ 38. (KEEPING DRAINS, ETC., IN ORDER.) All ditches and drains shall, at all times, be kept in good order and repair by the commissioners, and the lands affected by said work shall pay their proportionate amount of cost, which shall be in the same proportion that the lands were originally assessed.

§ 39. (PENALTY FOR FAILURE TO PERFORM DUTY.) For a failure to perform any of the duties imposed upon them by the provisions of this act, the commissioners so failing shall individually, upon complaint made under oath by any person who has paid a special assessment for the construction, maintenance or repair of such work, be liable to a fine not exceeding one hundred dollars (\$100), to be recovered in an action in the name of the people of the State of Illinois, for the use of the district interested, before any justice of the peace of the county, and all fines, when collected, shall be paid to the treasurer of the district.

§ 40. (DELINQUENT LIST—SALE.) It shall be the duty of the treasurer of each and every drainage district, to make out a certified list of such delinquent lands upon which the assessments remain unpaid, and the same shall be by him, on or before the 10th of March next after the same have become payable, returned to the county collector of the county or counties in which such lands shall lie; and it shall be the duty of the collector to whom such return has been made, to transfer the amounts thereof, from such returns, to the tax books in his hands, setting down therein, opposite the respective tracts or lots, in proper columns prepared for that purpose, the amount assessed against each tract or lot; and the like proceedings shall be had, and with like force and effect, in the collection of such delinquent assessments and the sales of said lands for the non-payment thereof, as in ordinary collections of State and county taxes by county collectors, and of sales of real estate by them for such non-payment and of redemptions from such sales.

§ 41. (PAYMENT OF DELINQUENT TAX BEFORE SALE.) Notwithstanding the returns of such delinquent tax, the said treasurer of the drainage district may receive payment of any such delinquent assessments and costs, and may give receipts for the same, but shall keep a memorandum of the same, and on or before the day of sale fixed by said county collector for sale of such lands, shall present said memorandum or list to said county collector, for the purpose of having the same checked or marked paid on the delinquent list in his hands; and all amounts collected by the said county collector by sale or otherwise, after deductions of his fees, shall be paid to the treasurer of the drainage district, on demand.

§ 42. (COLLECTOR OF DELINQUENT ASSESSMENT TO GIVE BOND.) When the certified list of such delinquent lands upon which the assessments remain unpaid has come into the hands of the county collector, as aforesaid, the said collector shall execute bond to the drainage commissioners for the use of all persons interested, in a sum not less than twice the amount of the delinquent assessments, conditioned for the faithful performance of his duties as collector of said delinquent assessments, of said drainage district, and that he will faithfully account for all moneys that by virtue of said delinquent assessments, shall come to his hands; and such bond shall be with such sureties as may be approved by the county judge, and said bond shall be kept and preserved in the county clerk's office.

COUNTIES NOT UNDER TOWNSHIP ORGANIZATION.

§ 43. (DRAINAGE COMMISSIONERS.) The county commissioners, in counties not under township organization, shall be the drainage commissioners in and for their respective counties, shall be a body politic and corporate, with like powers and duties as drainage commissioners as hereinbefore provided for. In all legal proceedings under this act their corporate name shall be "The Drainage Commissioners of . . . County, State of Illinois." In such counties the county clerk shall be the clerk of the drainage commissioners, and he shall perform all duties devolved upon clerks of drainage commissioners, as hereinbefore specified in this act.

§ 44. (PETITION TO FORM DISTRICT.) Whenever a majority of the adult owners of land, and owning more than one-third of any area of lands lying in a county not under township organization, and requiring a combined system of drainage or protection from overflow, desire to form a drainage district, they shall file in the office of the county clerk a petition setting forth the facts as provided in section three of this act; which petition shall be accompanied by a bond as in said section provided. It shall thereupon be the duty of the clerk to give notice that a meeting of the drainage commissioners will be held, as provided in section four of this act.

§ 45. (MEETING OF COMMISSIONERS—PROCEDURE.) The commissioners shall meet at the time mentioned in said notice and examine the said petition, and they shall thenceforth, in all preliminary and subsequent matters, as to the organization of such district, location of work, procuring right of way, awards of damages, levy of special assessments for benefits, confirmation of the same and other matters, proceed in accordance with the provisions of this act in regard to the duties and powers of drainage commissioners of townships, and shall in all cases be vested with the same powers and exercise the same duties as such commissioners.

§ 46. (APPEALS.) Appeals from the orders of drainage commissioners, confirming any special assessments in counties not under township organization, may be taken by any person interested who is not satisfied with the decision of the commissioners to the county surveyor, county treasurer and sheriff, who shall constitute a board of appeals, who shall meet when notified by the clerk for the purpose of hearing appeals in such cases; and at such meeting they shall proceed as hereinbefore provided for supervisors when hearing appeals in like cases. Either party aggrieved by the action of the board of appeals may appeal therefrom to the county court on the same conditions, under the same restrictions and with the like effect as hereinbefore provided for appeals from supervisors.

DISTRICTS COMPOSED OF LANDS LYING IN TWO COUNTIES, OR IN TWO TOWNSHIPS IN COUNTIES UNDER TOWNSHIP ORGANIZATION.

§ 47. (LANDS IN TWO COUNTIES—MODE OF PROCEEDING.) When lands lying in two counties, or in two townships in counties under township organization, would be benefited by a combined system of drainage, and a majority of the owners of such lands, owning more than one-third ($\frac{1}{3}$) of such lands, desire the formation of a drainage district, they may file a petition as provided in section three of this act, in the office of the clerk of that board of commissioners in whose jurisdiction the greater part of said lands are situated. It shall thereupon be the duty of said clerk to give notice as provided in said section, and at the meeting held in pursuance of

such notice both boards of commissioners shall act; and should a district be organized, all of such commissioners shall constitute the drainage commissioners of such district, and in the preliminary, and all subsequent proceedings in regard to formation of such district, construction of works therein, procuring right of way, the award for damages, the levy and collection of special assessments for benefits, the confirmation thereof and appeals therefrom, they shall proceed as hereinbefore provided: *Provided*, that all proceedings for condemnation of right of way and the assessment of damages consequent upon the construction of such work, shall take place in the county in which the lands affected are situated. The clerk in whose office the petition is filed shall be the clerk of such drainage commissioners.

§ 48. (APPEALS—HOW TAKEN.) When such district lies wholly within a county or counties under township organization, appeals from the order of the commissioners confirming special assessments shall be taken to three supervisors, as hereinbefore provided, but where the district lies in two counties, all of such supervisors shall not reside in the same county. When such district lies wholly within counties not under township organization, appeals shall be taken to the county surveyors, county treasurers and sheriffs of the several counties, who shall act as a joint board of appeals. And when the district lies partly in a county under township organization and partly in a county not under township organization the appeal shall lie to a board consisting of three supervisors from the county under township organization, chosen as provided in section nineteen of this act; and the county surveyor, county treasurer and sheriff of the county not under township organization shall act as a joint board. All of said boards of appeal in this section provided for shall proceed and determine the cases submitted to them in the manner and to the effect set forth in section twenty hereof. From the decisions of any of the boards of appeal mentioned in this section, appeals shall lie, as provided in section twenty of this act, to the county court of the county in which the land concerning which the appeal is taken is situated, and such appeal shall be tried in like manner and with like effect as hereinbefore provided in cases of appeal to such courts. Districts lying in two townships or counties shall be designated as Union District No. . . . , in . . . , and . . . township or counties, as the case may be.

SPECIAL DRAINAGE DISTRICTS.

§ 49. (HOW FORMED—PETITION, ETC.) Whenever a majority of the adult owners of land, who shall be the owners of more than one third of the lands in any area of territory lying in more than two townships, either in the same or different counties under township organization, or lying partially in more than two townships, in a county under township organization, and partly in a county not under township organization, shall file in the office of the clerk of the county court of the county in which the greater part of such lands shall lie, a petition setting forth the facts as provided in section 3 of this act, and praying that a special drainage district may be formed, it shall be the duty of said clerk to give notice by posting written or printed notices in at least six public places in such township or county in which said proposed district or any part thereof shall lie, and also by publication in some weekly newspaper published in his county for two successive weeks, stating the day when such petition will be heard, which hearing may be at any term of said court, occurring not less than ten days after the last publication above provided for. The petition above mentioned shall in all cases be accompanied by a bond conditioned for the payment of all costs to the officers of the court, or accruing to other parties by virtue of such proceeding, in case such district is not established; which bond shall be signed by at least three responsible persons and approved by the clerk.

§ 50. (HEARING ON PETITION.) It shall be the duty of the said court at the time set for such hearing, to examine the said petition, and if the court shall find, upon examination, that it is signed by a majority of the adult owners of the lands within said proposed district, and that such signers are the owners of more than one-third of the lands lying therein, the court shall so find. The affidavits of three credible signers of such petition that they have examined the same, that they are acquainted with the locality, and they verily believe that such petition is signed by a majority of the adult owners of lands lying in said proposed district, and that they are the owners in the aggregate of more than one-third of such lands, shall be taken as *prima facie* evidence of such facts, against all persons owning lands therein, and as conclusive evidence against all the signers of such petition of the facts therein stated, and that

they have accepted the provisions of this act as to the assessments of benefits and damages hereunder. At such meeting any other owners of land within said district shall be permitted to place their names on said petition if they so desire. Any person owning land in said district whose name is not on said petition may, at said time and place, appear and controvert any material statement in said petition, or any signer thereof may deny or withdraw his signature thereto on payment of his proportion of costs incurred to that date, and for the purpose of such hearing the court shall have power to examine witnesses produced at such time.

§ 51. (PROCEEDINGS ON HEARING—APPOINTMENT OF COMMISSIONERS.) Should the court find against the petitioners, it shall enter an order to that effect, and the petition shall thereupon be dismissed at the cost of the petitioners. Should the court find in favor of the petitioners, it shall enter an order to that effect, and it shall thereupon be the duty of the court to appoint three drainage commissioners for said district, who shall at once proceed to the examination, survey and organization of said district in all matters as provided in sections eight and nine of this act, and the clerk shall give notice of the time, when and place where the commissioners will meet to complete the organization of such district, which time shall not be more than thirty (30) days subsequent to the date of the appointment of such commissioners. At the meeting for completing the organization of such district the proceedings shall in all respects conform to the requirements of this act, as set forth in the matter of the formation of districts lying wholly within a township. Upon the filing of the order of the commissioners declaring such district organized, the clerk shall enter the same of record, and said district shall thereupon be deemed fully organized.

§ 52. (CORPORATE NAME—POWERS.) Each special drainage district organized as herein provided, shall be known and designated by a name, as " . . . Special Drainage District, in the county or counties of . . . , and State of Illinois." The commissioners thereof shall be a body politic and corporate, with like powers as herein conferred upon other drainage commissioners.

§ 53. (NOTICE OF ELECTION.) So soon as a special drainage district has been organized, it shall be the duty of the county clerk, who shall be the clerk of the commissioners thereof, to give notice by posting written or printed notices in at least six public places in said district, that on a day therein named, not less than ten days from the date of notice, at a place in said notice designated, an election will be held for the purpose of electing three drainage commissioners for said district.

§ 54. (ELECTION—COMMISSIONERS—TERM OF OFFICE.) At all elections held for the election of drainage commissioners, the drainage commissioners then in office shall be the judges of election, and in the absence of any of them the electors present may choose a person or persons to fill the vacancy or vacancies. Such elections shall be conducted in all respects in accordance with the general election laws of this State: *Provided*, that no person shall be eligible to the office of drainage commissioner, or to vote at any election held hereunder who is not a resident of and an owner of land in such district. The returns of such election shall be transmitted to the clerk of the commissioners, who shall canvass the vote as the returns for the election of county officers are canvassed, and the three persons having the highest number of votes shall be declared elected, and the clerk shall thereupon notify said persons of their election. The persons so elected shall determine among themselves by lot their respective terms of office, one of whom shall serve for one year, one for two years, and one for three years, or such parts thereof as may expire upon the election of their successors respectively; and annually thereafter, on the first Saturday of September, there shall be elected in each special district one drainage commissioner, who shall hold his office for three years, and until his successor is elected and qualified.

§ 55. (OATH—BOND—TREASURER—BOND—DUTIES—TERM OF OFFICE.) Said commissioners shall thereupon each take an oath to faithfully discharge the duties of his office as drainage commissioner, which oath shall be signed by him and filed in the office of the clerk. They shall then appoint some person who shall be a land owner within and a resident of said district, as treasurer, who shall give bond to the commissioners in such sum as shall be fixed by them not less than double the amount likely to come into his hands in any one year, which bond shall be signed by at least two responsible securities and approved by the commissioners and filed in the

office of the clerk. He shall hold his office for two years, but may be removed by the commissioners at any time for cause. He shall have like powers and perform the same duties herein provided for other treasurers of drainage districts. He shall pay out moneys only on orders signed by the commissioners, or a majority of them.

§ 56. (DUTIES OF COMMISSIONERS.) The commissioners shall then at once proceed to locate the drain or drains, ditch or ditches, procure the right of way, institute proceedings therefor, and for the award for damages consequent upon the construction of the proposed work, make special assessments for benefits, and in all the foregoing and subsequent proceedings, including the letting of contracts, the confirmation and collection of special assessments and all other matters they shall be governed by the provisions of this act, relating to the powers and duties of drainage commissioners of townships.

§ 57. (APPEALS.) Appeals from the orders of the commissioners of special districts confirming special assessments, if the district lies wholly within a county or counties under township organization, shall be taken to three supervisors, as provided for appeals in cases of districts lying wholly within a township or in two counties under township organization, as the case may be. If the district lies within a county or counties under township organization and a county or counties not under township organization, the appeal shall be taken to the joint boards of appeal of the several counties. From the decision of such tribunals appeals shall be as hereinbefore provided, and with like effect to the county court of the county in which the land upon which the assessment made is situated.

§ 58. (POWER TO BORROW MONEY.) The commissioners may borrow money not exceeding in amount, half the amount of assessments unpaid at the time of borrowing, for the construction of any work which they shall be authorized to construct, and may secure the same by notes or bonds bearing interest at the rate of not exceeding eight per cent. per annum, and not running beyond one year after the last assessment on account of which the money is borrowed shall fall due, which notes or bonds shall not be held to make the commissioners personally liable for the money borrowed, but shall constitute a lien upon the assessment for the repayment of the principal and interest thereon.

§ 59. (WHO TO BE TREASURER.) In all districts, in counties under township organization, the supervisor of the township in which the district is situated, shall be the treasurer of the district. When the district lies in two townships, the supervisor of one of the townships, to be designated by the commissioners, shall be the treasurer. When a district lies in a county not under township organization, the county treasurer, shall be the treasurer, and when the district lies in two counties not under township organization, the commissioners shall appoint the treasurer of one of said counties, the treasurer of the district. When a district lies partly in a county under township organization, and partly in a county not under township organization, the commissioners may appoint either a supervisor or county treasurer, as the treasurer of the district, as they may determine. The treasurer shall in all cases, give to the commissioners a bond in double the amount of the sum likely to come into his hands for the use of the district interested.

§ 60. (MEANING OF "DITCH.") The word "ditch" when used in this act, shall be held to include a drain or water course, and the petition for any such improvement, shall be held to include any lateral ditch, drain, or water course necessary to be constructed to secure the object of the improvement, whether the same be mentioned therein or not, and this act shall extend to and include the straightening of streams and water courses, and cleaning driftwood out of the same, and the making of such ditches or drains as may be found necessary to divide the overflow of any stream or water course.

AN OWNER, OR JOINT OWNERS AS TENANTS IN COMMON, TO PROCURE
OUTFALLS.

§ 61. (OPENING DRAINS THROUGH LANDS OF ANOTHER.) Any owner, or joint owners as tenants in common, desirous to drain the same and in order thereto deem it necessary that a new drain or drains should be opened through lands belonging to another owner, or that an existing drain or drains in lands belonging to another

owner should be cleansed, widened, straightened or otherwise improved, may apply to such owner, who is hereinafter referred to as the adjoining owner, for leave to make such drain or drains, or improvement in drain or drains, through or on the lands of such adjoining owner.

§ 62. (NOTICE TO ADJOINING OWNER.) Any such application as aforesaid shall be by notice in writing, under the hand of the applicant, and shall be served on the owner, and also on the occupier, if the owner be not the occupier. The notice shall state the nature of such drain or drains, or improvements in drain or drains, be accompanied by a map, on which the length and depth, and if an open ditch, the width, of the proposed drain or drains, or improvements in drain or drains, shall be delineated, and shall further state the compensation, if any, which the applicant proposes to pay, or which the applicant proposes that the adjoining owner shall pay.

§ 63. (ASSENT BY ADJOINING OWNER.) The adjoining owner may, by deed, under his hand and seal, assent to such application, upon such terms and payment of such compensation as may be agreed upon; and any assent so given, or agreement so made, shall be binding on all parties, their heirs and assigns.

§ 64. (ASSENT TO BE RECORDED.) The applicant shall cause to be recorded, in the recorder's office in the county wherein the land is situate, the deed containing the assent of the adjoining owner to the proposed drain or drains, or improvements in drain or drains, and, also, a map showing the location of the same.

§ 65. (WHEN OWNER DOES NOT ASSENT.) If the adjoining owner does not assent to the application, then the said person making the application may give notice, in writing, to said adjoining owner, and, also, to the occupier, if the owner be not the occupier, that he will, on a day named, not less than five days thereafter, apply to the drainage commissioners to locate said drain or drains.

§ 66. (DRAINAGE COMMISSIONERS MAY ACT.) Upon the receipt of such application, it shall thereupon be the duty of the drainage commissioners, at the time mentioned in said notice, to go upon the lands and examine the line or lines of the proposed ditch or ditches; and they shall have power to make such alteration, either in the location or mode of construction, as they may deem best, and may form a drainage district embracing such drain or drains, and shall enter on their record an order, in writing, organizing said drainage district, and such district shall thereupon be declared organized. The maps, as finally adopted, shall be signed by the commissioners, or a majority of them, and shall be recorded in the drainage record.

§ 67. (PROCEEDINGS FOR RIGHT OF WAY, ETC.) The further proceedings for procuring right of way, award of damages, levy of special assessments for benefits, confirmation of the same and other matters, shall be in accordance with the provisions of this act, which are applicable thereto.

§ 68. (FEES.) The commissioners and clerk, and members of boards of appeals shall receive one and one-half dollars, and if a civil engineer shall have been employed not to exceed five dollars per day, for the time actually employed in the discharge of the duties prescribed by this act; the compensation to be paid by the district for which the service may be rendered. Their accounts for services shall be rendered under oath and filed with the clerk, and kept by him with and among the records of his office. The treasurer shall receive, as his compensation, two per cent. of the funds collected by him, and one per cent. on the amount paid him by the county treasurer. The county treasurer shall be entitled, as his compensation two per cent. on the amount collected by him on delinquent assessments.

§ 69. (ACT NOT AFFECT PRIOR LAWS.) This act shall not be construed to repeal or interfere with the execution and enforcement of other laws on the subject of drainage, or levees and drains, passed by this General Assembly.

CORRESPONDENTS' REMARKS.

ADVANTAGES—PROFITABLE RESULTS—SUGGESTIONS.

To give the public the benefit of the practical experience of Illinois farmers who have realized some of the advantages of drainage, the following questions were submitted to a number of gentlemen, and their answers are given herewith, as fully as the limited space permits:

1. What amount of land have you drained? 2. How long since you began underdraining? 3. What was the general character of the land previous to its being drained? 4. Have you laid drain tiles in any land which was not previously such as would be called wet land, and was not liable to appear wet upon the surface? 5. What amount of drain tiles have you laid? 6. What sizes do you prefer for mains and side drains? 7. What depth, and at what distance apart, have your drains been laid? 8. How much earlier in the spring can drained land be worked? 9. Is the drained land more friable, and therefore capable of finer tilth? 10. Does draining lessen the danger of crops being winter-killed? 11. Do you find drained lands less liable to suffer from drouth than that which is undrained? 12. What do you estimate the per cent. of increase in your crop in consequence of drainage?

E. M. Husted, of Roodhouse, writes as follows:

"I began experimenting in draining twenty-four years ago, with drains made of oak boards six inches wide, nailed together like an eave trough, and set on cross pieces at the bottom of the ditch, with bottom up, and then filling the ditch above them. In two or three years the crawfish filled them up and destroyed their usefulness. Next tried the mole plow, which did good work at first, but soon gave out, owing to washing out where there was much fall and filling up where it was slight, and also owing to the work of the crawfish. Then began studying the subject of drainage, and visited Whitehall, where there was a little one-horse pottery, and tried to induce the proprietors to get machinery and begin the manufacture of drain tile. After two years incessant urging they consented to do so, on condition of my agreeing to take of them \$100 worth of tile, and find another customer for the same amount. After six or eight months the machine was got ready, and the proprietors were apprehensive I would go back on them, but I kept my word, and continued a regular customer until I had spent more than \$1,000, and have since paid them nearly as much more. I claim, therefore, to have been the means of introducing the drainage in this section.

"My works attracted attention. Men came from long distances to see how the tile were laid, and I was subjected to much ridicule for putting so much money where I never would see it again. Some would say the water could not get into the tiles, others that they would fill up, and still others that I would get my land so dry it would not produce anything at all. My experience, however, has silenced their objections. The manufacture of tiles at Whitehall and elsewhere has become an immense business, and there is no estimating the amount the farmers have gained by it. At first, of course, I drained the lowest and wettest lands on my farm. I have since put in tiles in land most people would think dry enough; but now, if I had the means, I would put in tiles three feet deep and not more than one hundred feet apart, all over my farm. The only mistake I made was in not getting my mains made large enough to carry off the water as fast as needed in wet spring seasons. It costs a little more at the outset, but pays in the end."

A. J. Harlan, of London Mills, in answer to the question, "What do you estimate the per cent. of increase of your crop in consequence of drainage?" writes:

"The increase in crops in my case is not only a per cent. but principal and all, as the land I drained produced nothing previous to being drained, and now I raise just as good crops there as anywhere."

George Judd, of Springfield, writes:

"I have expended in improvements on my farm over ten thousand dollars within the past six years, and for nothing that has given so much satisfaction as that invested in tile under-draining. I have drained two hundred acres and commenced tiling in the spring of 1877. The character of the land was level prairie, with occasional depressions or pockets, where water in wet seasons would stand, covering from one-fourth to an acre of ground. One pond of four acres in which water was always to be found, is now planted in corn, and dryer land is not to be found on the place. Have laid five miles, and used four inch tile exclusively; laid it two and one-half to five feet

deep, always aiming to get below frost. Laid the tile following the depressions in the land to an outlet for same without regard to exact distances apart. Find they draw the water about 200 feet. This season worked our drained land a month earlier than usual, and now (May 12th), land across the road of same character is too wet to plow, and mine is planted in corn. The land is much more friable and works nicer than undrained land. The drained land stood the drouth much better for the tiling, and produces from 15 to 25 per cent. more. I have no interest in the manufacture or sale of tiling, but will endorse *all* the most sanguine friend of the system has to say in its behalf."

J. D. Faris, of Charleston, writes:

"I have drained, or partially drained, between seven and eight hundred acres, beginning about 16 years ago. The land which was my first object in draining was low sinks or ponds, the soil of which is a deep black loam; but being kept wet and cold until midsummer, was unfit for cultivation. In draining these places I was obliged to run my drains through what I considered comparatively dry land. I found that the productive qualities of these lands were increased fully 10 per cent. I have laid about 4,000 rods of tile, the mains being five and six inch, and the side drains three and four. My first drains were laid very shallow; but finding this to be a false idea, my drains of late years have been laid deeper, being from three to four feet deep. My drains are from 10 to 30 rods apart, but finally I hope to have a drain every ten rods. Land which is properly drained can be worked from one to two weeks earlier than undrained land. It is rendered more friable, and crops are undoubtedly rendered less liable to being winter-killed. Drained land is less liable to suffer from drouth than undrained land. The average increase of my crops in consequence of drainage is at least 50 per cent.

James Gaines, Ridge Farm: "I own 4,880 acres of the best blue grass lands in Eastern Illinois. I have been ditching and using mole, or underground ditch, 25 years, and pronounce it a failure. Have used tile draining 15 years and think it is the only true mode of draining.

"Tile, properly laid, will last for all time. My tiling put in 15 years ago does just as well as that put in last year, and tiling laid in England 50 years ago is doing well yet. My land is about all prairie land—black loam, very deep soil, heavily charged with lime. Have expended \$500 per year for some years in tiling, and expect to expend that sum each year until my farm is thoroughly drained.

"I use more four inch tile than any other size, and prefer the sole tile, flat on one side, which, I contend, is the best shape—they are not so easily displaced as the round tile. I lay tile from 30 to 42 inches deep. The ditches should only be wide enough at the bottom to fit the size of the tile.

"Thorough drainage is a great benefit to the State. It makes the country healthy, reclaims and makes productive low, wet lands, heretofore entirely worthless. The land can be cultivated earlier in the spring and soon after heavy rains, and one crop will generally pay for tiling. I am tiling pastures, and find it pays."

J. H. Pickrell, Harristown: "Have drained about 350 acres of land, requiring about five miles of tile in the sloughs or natural drains, with mains and side drains wherever there had been a pond or wet piece of land. Have laid drains between two and three years. The land was gently rolling, with table or flat lands on the summits, where there were more or less deep depressions. On part of it the water would hold till the middle of a dry summer, and all the year in wet seasons. Prefer for mains from four to six inch tiles—the larger the better for long level drains. Short drains, with plenty of fall, will do with less size. For side drains from two to four inches, owing to the length and width of space between them. The depth varies from three feet in the basins to seven feet on the rises. The distance apart for side drains have been varied from 20 to 40 feet, as seemed necessary to carry off the water quickly."

Titus Sudduth, of Sherman, writes:

"I commenced laying tile some four years since and have put down some five miles, and expect to put down some three miles the coming summer and fall. My experience in draining has been mostly in draining wet and boggy sloughs, making up through high rolling land, and in every case with perfect success, enabling me to plow across the worst kind of bogs and sloughs. Also have drained some flat, cold lands with satisfactory results. There is little or no land in the flat prairies that is not susceptible of drainage making it the most productive land, instead of being a source of bankruptcy, as has been the case in a number of instances under my observation. I think tile should be three feet deep, using five or six inch tile for the mains and four inches for side drains. I think to drain an eighty acre tract of wet land, one main through the center, or as nearly so as practicable, with side drains at about 15 rods apart, or as nearly so as is practicable, will thoroughly drain the wettest land so as to produce a crop any year. I consider wet undrained land of little value, say in comparison \$20 per acre—same land well drained would be worth \$50

per acre. A good investment for the expense of tiling. The line for laying tile should be very carefully selected, and none but the best tile used. Good tile will last for ages. There are few sloughs that require a larger tile than five inches. My five inch tile, one mile long, seldom runs full."

J. S. Bentley, Aledo, Mercer county, writes: "It is ten years since I commenced underdraining; the land I have drained was wet sloughs and was useless before drained, causing much loss of time in turning. I use six inch tile for mains and 3 to 4 for side drains, and lay $3\frac{1}{2}$ feet deep and 6 rods apart. The increase of crops from drainage, in my case, was from nothing to 80 bushels of corn per acre—much of the richest land in Illinois to day producing nothing but disease and taxes. This waste land if properly underdrained would nearly pay the expense of tiling in the first crop. It is only necessary to take a man into the cornfield to convince him that underdraining pays."

George Garrison, Rushville, Schuyler county, writes: "I commenced draining in 1844, and have drained the greater part of four hundred acres, most of which was rolling prairie with sloughs, and a portion flat prairie land requiring about 30,000 feet or nearly six miles of tile. Have only drained land that especially needed it, and have laid tile from $2\frac{1}{2}$ to 3 feet deep. Find that in ordinary seasons the land can be worked two weeks earlier than previous to draining. Drainage is a great benefit to winter wheat, and crops are much less liable to suffer from drought on drained lands. The increased production is estimated at least twenty per cent. In 1844 our lands were all very wet, and my first ditches were $2\frac{1}{2}$ feet deep, in which poles were placed within $1\frac{1}{2}$ feet from top and then covered over with dirt. This drain answered a very good purpose for a limited time. My second experiment was to dig a ditch two feet deep, eighteen inches wide, then with a narrow spade cut down ten inches deeper, covering this second ditch or vault with two-inch plank and covered it over with the dirt taken from the ditch. This vault answered a good purpose as long as the plank lasted. The third plan of drainage was to fill half of a $2\frac{1}{2}$ foot ditch with gravel and sand, which answered a good purpose for a short distance. The fourth experiment was to lay brick crosswise in the bottom of a ditch $2\frac{1}{2}$ feet deep, then set up brick on edge for the sides and cover over the top with brick. This was followed by using hollow brick, and then the economy of the mole ditch induced another trial by taking off the large ball, and instead of running one ditch in the center of the slough, one was run on both sides, and in order to prevent these ditches from clogging, a well was dug two and one-half feet below the mouth of the ditch. I cleaned out one this week that has been in operation thirteen years, and it runs as well as it ever did. My experience convinces me that the pole ditch is not durable, the poles rot too soon. The plank ditch makes a good harbor for muskrats, minks and rabbits the short time it lasted. A mole ditch in the middle of a slough would not last but three or four years at farthest, the surface water washes it in holes. The gravel ditch will pay where there is a slow process of the water. The solid and hollow brick makes a good drain, but is too expensive. The mole ditch, when not too large, will last a long time.

Tile ditches have given perfect satisfaction, and when I say tiling land will pay 20 per cent. I do not advise farmers to borrow money at that rate of interest—but tile drain all you can—use all your surplus money in this direction—if you have three horses and only run one team, sell one horse and put him in the ground in the shape of tile and ditch where it is most needed, and you will soon make enough to ditch your dry land. In wide sloughs run two ditches. I have ditches four rods apart in wet sloughs which made the center perfectly dry. When running ditches in sloughs where it is liable to wash keep away from the center where the surface water runs, and in all cases tile on the side that has the widest wet space. Cross the slough from time to time in order to reach the most wet ground. This course will lessen the liability of washing and injuring the drains.

In draining spouty hill sides I run tiles at the upper edge of the spouty land, and such land that was perfectly worthless is now as good as any drained lands."

E. L. Lawrence, Head Farmer University Farm, Champaign:

Four hundred and eighty acres of the University farm has been partially drained. About two-thirds of what was contemplated is now completed. The land is moderately rolling, having a good slope. The farms are among the driest in the county. The drains have followed up the course of the ravines with laterals running the course of other depressions and tapping ponds near the summit. Some tile was laid eight years ago in land which was not previously such as would be called wet land. The tiles are in good condition but do not discharge even after a heavy rain and are therefore to my mind useless. A drain does no good unless it reach the "water line." Have laid about 45,000 tile. The smallest I have used is two inches and the largest seven inches, and in one instance for sixty rods two six inch tiles were placed side by side. Some of the tile has been laid $5\frac{1}{2}$ feet deep and some less than 3 feet.

The distance between drains depends on the character of the land. In some instances one drain across a forty acre lot is all that is required. The figures of "professionals" who place the cost at from \$40 to \$60 per acre, have prevented many from beginning the work, when all that the circumstances required could be done for one-tenth of the sum named.

This has been a wet Spring, yet I shall finish planting corn fifteen days earlier than usual—the middle instead the last of May. My experience has been that one acre of corn planted the first of May will yield as much as two acres planted the first of June. We often think our late corn equally good. When the corn is fit for market, the scales will tell a different story.

Twelve hundred rods of tile laid in January and February last, cost 73 cents a rod, including hauling and time in surveying the ditches and superintending the work."

J. I. Blackman, of Paris, writes:

"It is about ten years since I commenced draining and have drained over one thousand acres. The land consists of prairie and timber land, and drains generally have fair outlets. The portions drained were too wet for general cultivation, and somewhat cut up by wet sloughs. Have laid about six miles of drains, using six inch tile for mains down to as small as two and a half inch tile for side or extensions. Would prefer now to have them larger. Three feet has been the usual depth, and laid in the lowest ground where the water naturally gathers. Drained land can be worked two or three days sooner than on what we term dry land. The increase of crops on drained land is at least 10 per cent., and money spent in drainage pays at least 25 per cent. as an investment. Have been putting in about 200 rods of wooden drain lately. Think it will drain sooner than tile, and if it was durable would prefer it. Have had some trouble with my tiles filling or stopping up with grass roots or something growing in them in long fine strings, similar to corn silks in appearance, which seems to form in the bottom and gets loose and then bunches and nearly

destroys them. I cleaned out one of over one hundred rods last fall by taking up tile about three feet apart, and running wire through with a swab at the end. Have other lines that are not carrying more than half their capacity on account of obstructions. The tile cleaned had been in operation about six years. Have experienced some trouble on plowed ground after heavy rains with surface washing on top of my drains."

J. D. Gillett, of Elkhart City, writes:

"I am satisfied from my experience in tile draining that all our flat land can, by tiling, be made the best farming lands in Illinois. The effect of it on our wet, flat lands is really wonderful; for instance, take a tract that has been tough, the nature of the soil such that no plow would run through it without cleaning every few rods; by tiling I find it changes the soil to a lively loose nature, so that the plow runs through without the least trouble, doing as good work and with as much ease to the team as on the high rolling lands. This effect takes place in quite a short time, not to exceed thirty days after tiling. On tilling our low, wet swales that we encounter in most of our corn-fields they become firm and solid in three days after the tile is laid. Some of mine before tiling would mire a team while hauling out the tile for work, yet in three days after the tile was laid I could go over the same with a full load without any extra draft on the team. I do not see any reason that will prevent our making good roads throughout our State in all flat sections, by laying tile in the centre of the roadway. This item is of great importance to all, and in time I think all our flat roads had better be tiled rather than be made high by scraping from the sides. The cost of tiling per rod is according to the size of the tile used. Three inch tile that I used in working Mettler's patent tile laying machine cost 65 cents per rod. The tile came from Whitehall. It cost no more to lay, by hand, large tile than small. The cost will run from 75 cents to \$1.30 per rod, for tile from three inches to six. If cheaper tile is used it will not cost as much. I think tile will be made much cheaper in the next twelve months than in the past. I should have stated that I paid \$25 freight per car for my whitehall tile. In a short time I think we shall have tile manufactured in all districts where the demand will justify it, which will save the charge of railroad freight."

H. L. Sanford, of Elkhart, writes:

I herewith send you a statement of my experience in tile draining. I rented 800 acres of land for a number of years, a good deal of it being low land. After farming it for several years I saw it was going to use me up if I did not get it drained, for I was not raising any crops. Two years ago I commenced draining with tiles. At first I put in all small tile, but soon changed my plan, for I found it did not take the water off fast enough. I have used larger tile ever since; it costs no more to put it in, the only difference being in the cost of the tile. I began with 4, 3, and 2½ inch tile, now I use very few 3 inch, and from that up to 8 inch. I have no rule as to the distance between the strings of tile; they must be put in as the land requires. On my low, flat land I have as many as 5 strings to the quarter, and some only need one or two. I have expended as high as \$10 to the acre on one tract of 70 acres; I did not get it drained until July of 1877, and that year there was very little corn raised on it, and in some places none at all; and in 1878 where there was no corn the year before, it yielded 70 bushels to the acre and as good corn as there is in this part of the county.

After the first big rain in the Spring of 1878, I was afraid this piece of land would be all under water, for I thought the tile could not take water off. I felt discouraged and did not go to see it for two or three days afterward, and was surprised when I got there to find the men plowing in the lowest part of it, and they were doing good work; while land not tiled, and considered dry, could not be plowed for several days after that, and none of the heavy rains of that year kept the men from the field more than two or three days at a time. Ditches ought to be 3 feet deep, and better deeper if outlets can be had. I have put in 12 miles of tile now, and have yet 3 or 4 miles to put in on the 800 acres. I never run a ditch without water, for if it runs out of the open ditch it is sure to run out of the tile. My drains are all giving good satisfaction. My faith was strong in tile draining before I commenced, but the result is beyond my expectation, and I believe every farm in the State can be improved by draining. I have spent about \$5,000 in draining this land, and think that it would now sell for \$10,000 more than it would have if not drained, and am of the opinion that draining is one of the greatest improvements in this country, for the crops can be doubled and in some cases produce even a larger yield than that, by this process. My land has raised three times what it did before draining, and now I have a good foundation to work on, and I feel like the man who built his house upon a rock, and when I see men putting in crops on their low land without draining such, it reminds me of the man who built his house on the sand, for when these big rains come they are bound to go, crops and all, and this low land without being drained is like whisky, it will use up the best of them if they will stay with it, but when drained is the best land in this county.

In 1877 on 240 acres of untiled land we raised not more than 2,160 bushels of corn, or an average of only 9 bushels to the acre.

In the Spring of 1878 we commenced to tile this tract. Did not however get much of it done before planting was begun. In fact the greater part of it was not tiled until in May and June, hence the full benefit of the tiling was not realized in the crop of 1878. Thirty acres having been seeded down, there was left for corn this year 210 acres. From these 210 acres we have sold 6,000 bushels, and have about 1,000 bushels still on hand—making a yield for 1878 of an average of 33½ bushels to the acre.

On another tract of 70 acres of untiled land there was raised in 1877 only 500 bushels, or about 7 bushels per acre.

Having tiled this land I offered it in 1878 to the renter who had it in 1877 for one-half of the corn it would produce. He refused to take it, but rented untiled land of a neighbor, agreeing to pay \$4 per acre cash rent. The result was that he was glad to take \$20 for his entire crop and to be released from paying the cash rent as he had agreed. The owner of the land did not realize more than \$3 per acre as the proceeds of the corn raised.

The 70 acres of tiled land above mentioned was taken by another man who had more faith in tile draining. The crop from the 70 acres in 1878 was something over 3,500 bushels, an average of a little more than 50 bushels to the acre. Thus after delivering 1,750 bushels in payment for rent, he had the same amount left to pay him for his season's work.

On these lands there are places where before tiling there had never been raised an ear of corn, the ground being low and swampy, but since it is tiled these same spots have grown heavier crops than other of like extent in the fields.

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